

# ANNALS OF SURGERY

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# ANNALS OF SURGERY

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No. 1

## ORIGINAL MEMOIRS.

### ANEURYSMORRHAPHY.

TREATMENT OF POPLITEAL ANEURYSM BY THE RECONSTRUCTIVE METHOD.\*

BY JOHN FAIRBAIRN BINNIE, M.D.,

OF KANSAS CITY, MO.,

Professor of Surgery in the University of Kansas.

SINCE Matas read his classical paper on endo-aneurysmorrhaphy before the American Surgical Association in 1902, much attention has been devoted to this subject. It is not my intention to make any effort to cover the whole field of the surgery of aneurysm, but I will confine myself to a consideration of the possibility of obliterating the aneurysm and at the same time reconstructing the artery in such fashion that the circulation through it may be restored. For a clear understanding of what may possibly be attained and of what can surely not be attained, it is necessary to refresh our memories as to the common varieties of aneurysm.

1. If a small area of a pneumatic tire becomes degenerated the pressure of the air causes a local, more or less spherical, bulging at this spot (Fig. 1). If the bulging part is opened we see that it is a sac with a small opening communicating with the interior of the healthy tire (Fig. 3). The appearance of the tire and the sac in longitudinal section is

\*Read before the Section on Surgery, New York Academy of Medicine, March 6, 1908.

shown in Fig. 2. This corresponds accurately to the ordinary sacculated aneurysm.

2. If the degenerated area of the tire includes the whole circumference of a limited section of the tire, then the tire endeavors to dilate uniformly, in a fusiform fashion, but is prevented by the felly or solid rim of the wheel (Figs. 11, 12, 13). On opening the dilatation we find it is a sac with an opening at each end. The sac is *not* a pouch of the tire; it is the tire and its whole wall is degenerated. One part of the sac wall is not evidently distended simply because the felly supports it; this gives a superficial and fallacious appearance of pouching. The condition corresponds accurately to a fusiform aneurysm which lies against and is supported by bone and can to some extent mimic a sacculated aneurysm.

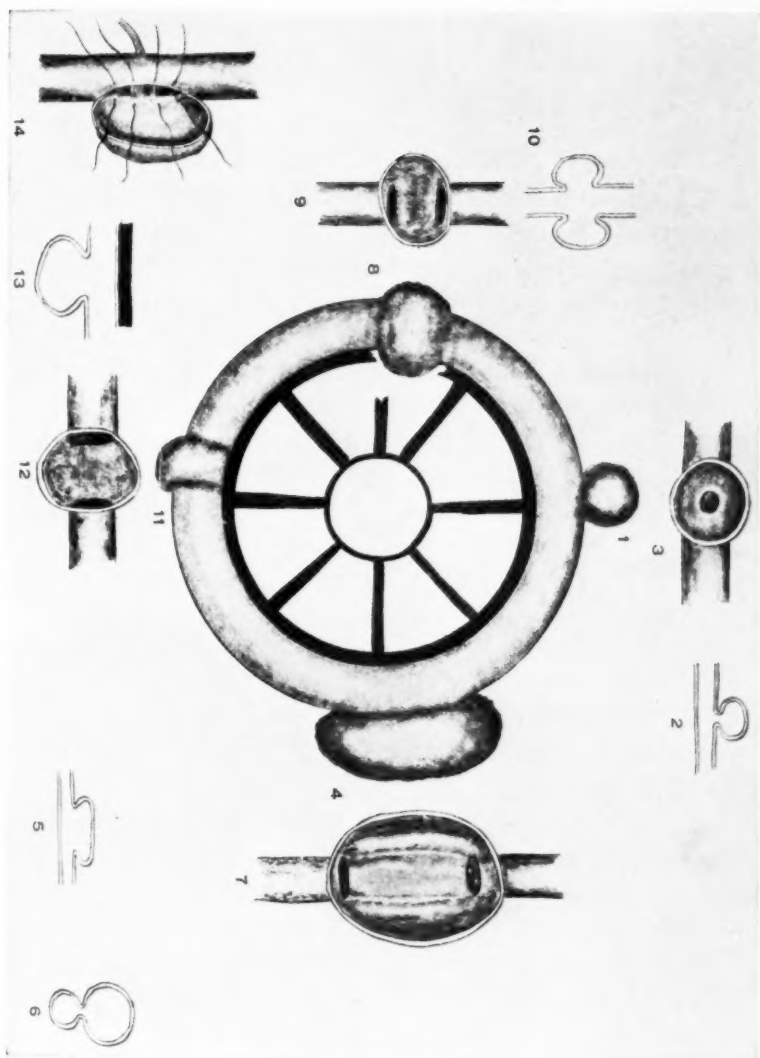
3. The degenerated area includes the whole circumference of a limited section of the tire, but the felly is absent (Figs. 8, 9, 10). A fusiform dilatation results and corresponds accurately to a fusiform aneurysm.

4. The degenerated area involves considerable of the length, but little of the width of the tire. Corresponding to this area there is bulging of the tire (Figs. 4, 5, 6, 7). If the sac is opened we see two openings, but these openings are connected one with the other by means of a distinct groove or gutter consisting of sound material. The form of defect is identical with that first mentioned except that the connection between the sac and the lumen of the tire itself is a long slit instead of a round hole. This corresponds accurately to a sacculated aneurysm, but a sacculated aneurysm which mimics and is often mistaken for a fusiform aneurysm. The illustration used by Matas when describing reconstructive endo-aneurysmorrhaphy applied to fusiform aneurysms shows distinctly this type, not the fusiform type, of aneurysm.

If a fusiform aneurysm is ever the result of direct injury to the vessel without there being pre-existent disease of the wall, it must be extremely rare. To me it seems almost an impossibility.

The development of an aneurysm is generally to be re-

FIG. 1





ferred to some series of strains acting on a vessel whose strength has been diminished by pre-existing disease. This view is supported by the facts that laboring men are the usual victims and that in about 80 per cent. of the cases a history of syphilis is present. Atheroma is commonly and vaguely accused of being the predisposing cause of aneurysm but atheroma is most marked in the aged while aneurysm seems to prefer victims of from 30 to 50 years. If atheroma was the predisposing lesion we would then expect it to be most common in the aged and as atheroma is very wide-spread in its effects on the vessels one would expect multiple aneurysms to be very much more common than they are.

Pierre Delbet notes that while the popliteal artery is a favorite site of aneurysm it is not a common site of atheroma; that plaques of atheroma are rarely found near aneurysms and never in recent aneurysms; that when plaques are found in the sac, they are secondary,—the sac being an old one. He believes with Eppinger that the cause of aneurysm is mechanical injury causing rupture especially of the middle coat.

Malmsten thinks that gummatous degeneration of the middle coat of an artery is the predominant factor in the genesis of aneurysm. Sansom states that an aneurysm may be seen in an otherwise healthy aorta and quotes Sutton as writing, "I have had a sense of awe on looking into the body and seeing that, while all the other organs and tissues were so exceedingly healthy, death had been caused by so limited a disease."

Councilman regards arteriosclerosis as the most common cause of aneurysm; with Thoma, he believes that it is most common in the beginning of the arterial disease when the degeneration of the media is not compensated for by thickening of the intima and when the individual is still capable of severe and sudden muscular exertions which suddenly raise blood pressure and can cause injury to the already weakened intima. These views of Councilman seem to reconcile many conflicting notions.

From the preceding paragraphs it seems that while an

artery as a whole may be diseased and somewhat weakened, yet one limited area thereof is so much more affected either by the disease or by concomitant injury that it gives way while the rest of the vessel remains capable of discharging its functions satisfactorily. If these arguments are in accordance with fact, and for various reasons facts are hard to establish in this disease, then it is reasonable to suppose that if sufficient arterial wall is left to re-establish the arterial tube and this arterial wall, though probably diseased, is not too much degenerated, then it may be possible safely to close with suture the communication between the artery and sac. In the case of a fusiform aneurysm nothing short of excision of the diseased segment of artery and end to end anastomosis of the more or less healthy arterial stump or the implantation of a suitable segment of vein (I am only discussing reconstructive operations) could be of any conceivable value. The reconstructive operation of Matas seems to me out of the question under such circumstances. In a sacculated aneurysm provided that the opening between the vessel and the sac is not too wide, *i.e.*, provided a sufficient amount of the circumference of the vessel remains sufficiently healthy, then a reconstructive operation may give good hope of success.

I have used the method originally outlined by Matas in two cases. In the first I did not recognize at the time that I was doing a so-called reconstructive operation. I closed the single small opening into the sac with catgut and then obliterated the sac by rows of sutures. (Transactions Am. Med. Assoc., Section on Surg. and Anat., 1904.)

The second case was the following:

S. W. K., 67. Seen June 23, 1907. Perfect family history. No syphilis. Three years ago knocked down by automobile the wheels of which passed over left leg just below the knee. Much bruising. Confined to bed one week; crutches two weeks. Apparently absolute recovery.

About three weeks ago stepped into "squirrel hole" with left foot in such a manner as to cause great dorsal flexion of the

foot. At this time he felt "something give way in calf." Pain was not severe but swelling soon appeared in popliteal space. This swelling increased in size until patient went to bed a week ago.

*Examination.*—Heart normal. No distinct arteriosclerosis. Urine normal. Large pulsating tumor at popliteal space. No tibial pulse palpable.

*Diagnosis.*—Popliteal aneurysm.

June 24.—Ether. Elastic constrictor to thigh. Longitudinal incision into tumor revealed a cavity full of soft, black, non-lamellated blood clot. Cavity had no distinct walls and was size of two large fists. After the clot was removed a ruptured aneurysm as large as a medium-sized orange was found communicating with the cavity through a  $\frac{3}{4}$  in. opening about  $\frac{1}{2}$  in. from the remnants of the arterial trunk. The walls of the aneurysm were fairly healthy. On splitting the true aneurysm sac two arterial openings were found about 1 to  $1\frac{1}{2}$  inches apart. Fairly healthy arterial wall, consisting of about  $\frac{2}{3}$  the circumference of the artery, united the two openings and formed a groove on the bottom of the sac. A catheter (Fr. 15) was put into the arterial openings and the communication between the artery and sac was closed by iodized catgut sutures, the catheter being removed before the sutures were tightened. Obliteration of the sac by means of continuous catgut suture. Cigarette drain in the blood cavity first encountered. Skin wound closed. Dressings applied. Limb placed in vertical position. Constrictor removed. The condition was one of ruptured traumatic aneurysm. Owing to the impossibility of obliterating the false aneurysmal cavity, healing was slow but the aneurysm has remained cured.

In both cases reported and in a similar one I saw with Dr. W. J. Frick, the result as regards *cure* of the aneurysm, was good, but in none of these cases could it be proved that the circulation was re-established through the vessel. Judging from the experiences of Hertzler and others in arterial surgery, the mere fact that catgut, and iodized catgut at that, was used for the closure of the neck of the aneurysms ought to mean that obliteration of the vessels took place and the attempted *reconstructive* became in fact, successful *obliterative* opera-

tions. Each of these cases seemed to me suitable for attempts at reconstruction, but the technic employed outraged every one of the principles elaborated by Carrel and was foredoomed to failure.

In a third case I endeavored to utilize the principles of modern arterial surgery.

H. H. G., 40. Colored. Barber. Smallpox 6 years ago. Syphilis 15 years ago, treated for three months. Nov. 14, 1907. Fourteen weeks ago noticed pain on straightening left leg. Twelve weeks ago noticed swelling in left popliteal space which has gradually increased in size. Unable to extend knee. Pain severe enough to disturb sleep. Pain increasing. Circumference left leg at upper margin patella 16 inches as compared to 14 on sound side. Posterior tibial pulse present left side but weaker than on right. Temp. 99.8. Pulse 128. Large pulsating popliteal tumor.

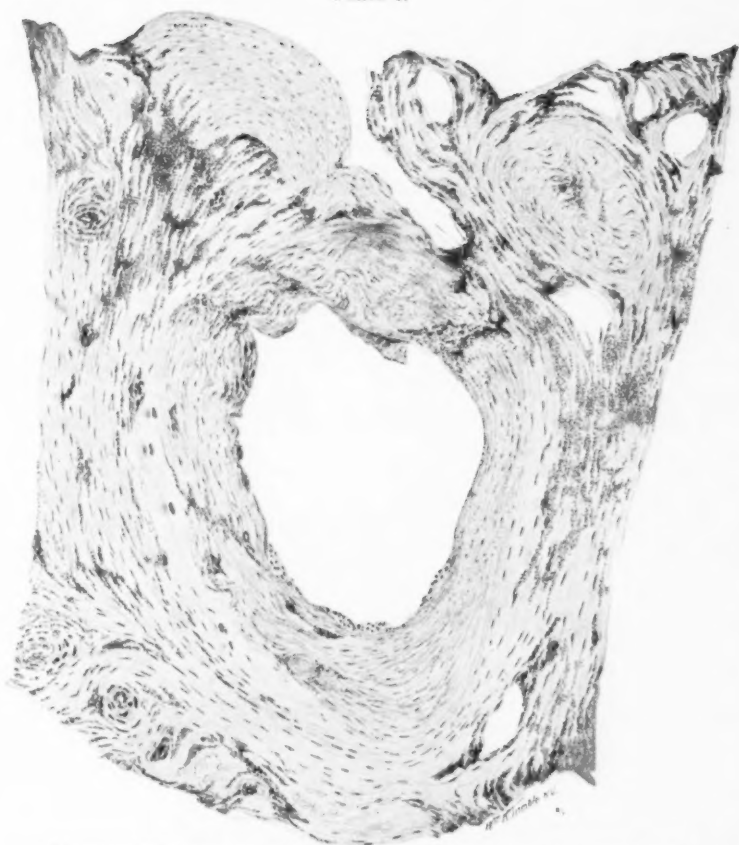
*Diagnosis.*—Popliteal aneurysm.

Nov. 15, 1907. Elastic constrictor. Longitudinal incision into tumor showed a large, irregular cavity full of clotted blood. On removing blood clots a ruptured aneurysm was found containing much fibrinated clot, which was removed. The walls of the true aneurysm sac were very ragged and friable. On the deep surface of the sac there was an oval opening about  $\frac{3}{4}$  to 1 in. in longitudinal, and  $\frac{3}{8}$  in. in transverse diameter. This opening formed a trough with three orifices (besides that one leading to the sac). Two of the orifices were the proximal and distal orifices of the popliteal artery, the third and smaller (opposite the hiatus) was evidently a branch.

The patent portion of artery was well and gently washed with salt solution and then smeared with vaseline. The hiatus was closed as in the Matas operation but vaselined No. 1. von Braun's hemp was used as suture material. Two rows of these continuous sutures were inserted. There was not enough aneurysmal sac of strength sufficient to permit suture obliteration of the sac. This was unfortunate as the obliterated sac is a great support to the line of arterial suture. It was impossible to obliterate the false aneurysm cavity. Elastic constrictor removed. No bleeding.

The deep wound or cavity was drained and the superficial

PLATE I.



Microscopical appearance of section cut through scar of repair in vessel wall.



wound closed. Dressed. Leg was elevated. The foot was warm and the posterior tibial pulse was perceptible. Owing to the fact that a sutured artery was left unsupported, passing through a non-obiterated cavity, an elastic constrictor was arranged round the thigh in such a manner that it could be tightened at a moment's notice.

Nov. 18. Dressing changed. Deep dressing were saturated with blood but were dry. Removed drain. No discharge. No pain. Tibial pulse clearly felt.

Nov. 29. Up till yesterday tibial pulse good. Yesterday being Thanksgiving day and the patient feeling well, he celebrating by shaving himself and moving about in bed freely. At night he felt considerable pain in the thigh and calf. On examination I found a pulsating swelling in the popliteal space; œdema of the leg; no tibial pulse; foot warm.

Nov. 30. Ligation femoral artery at apex of Scarpa's triangle. Reopened old wound and drained. Dec. 31. Has been home for some time and felt well. Wound in popliteal space almost closed. During last night sudden severe hemorrhage. Constrictor applied by patient himself. Seen by Dr. R. M. Schauffler who gave him proper emergency treatment. This morning reopened popliteal space in which there is a cavity with rigid friable walls. The tissues are so friable that local means of permanent hæmostasis are impossible. The patient is weak. Amputation lower third thigh. Recovery.

*Pathologist's report (DR. F. J. HALL).—*"The specimen consists of a pyriform mass of tissue 14 cm. by 8 cm. in diameter. From apex to base of this mass is found the popliteal artery surrounded by muscle and adipose tissue. Throughout much of the tissue are streaks of effused blood and inflammatory induration. Toward base of mass is an irregular cavity measuring 5 by 5 cm. It is lined by a ragged grayish membrane. On one side of the cavity is perceived a round opening communicating with the popliteal artery. On one edge of this opening is seen a knotted suture. At the bottom of the cavity is a ragged opening that extends through the muscle mass behind. On posterior aspect of specimen is found some clotted blood overlying a considerable area of muscle and fat tissue that is thoroughly impregnated with effused blood. Section through the artery near the place of rupture shows interior of artery slightly irregular with a definitely thickened wall and surrounded by a mass of hemorrhagic inflammatory tissue.

*Microscopic examination of section cut through scar of repair in vessel wall.*—The arterial wall throughout its entire circumference shows

great distortion and thickening of the different tunics. It is with difficulty that the various coats are distinguished. An irregularly thickened spongy tissue, poor in cells, takes the place of the intima. The lining endothelium is absent. The inner elastic membrane cannot be distinguished. The media shows as a greatly thickened tunic of hyaline connective tissue, in which the fibrillation is all but lost, the individual bundles fusing into one another leaving narrow clefts occupied by slender structureless nuclei. In places the media is penetrated obliquely by small hyaline walled vessels surrounded by round cells and a few polymorphonuclear leucocytes. In several places in the media, the bundles of fibres are separated by an amorphous granular bluish staining material that seems to be a molecular degeneration of an infiltrate similar in all respects to gummatous matter. At one point in the vessel wall is an obliquely placed pathway made as if by cutting instrument. At the point where this enters the lumen of the vessel, is a mass of fused red blood cells and degenerated fibrin threads entangling a few polymorpho- and mononuclear leucocytes. The space between the cut ends of the connective tissue bundles of the vessel walls is occupied by a mass of lumpy structureless pink-staining material, amid which are entangled polymorphonuclear leucocytes, round cells and giant cells of the foreign body type. Immediately adjacent to the walls of this space are a few *spindle-cell elements* (fibroblasts), and an *extremely few new-formed capillaries*. At no place do the fibroblasts bridge the gap. As the incision passes out of the vessel into the external coats, many polymorphonuclears are seen held in the meshes of degenerated fibrin and fused red blood cells. Many narrow clefts in the externa in the region of the wound are tightly packed with deeply staining round cells."

In this case the operative technic used differed from Carrel's in that freshly cut arterial wall was not approximated, but two endothelial lined surfaces were brought together as in Dorrance's method of arteriorrhaphy by eversion. The artery as a whole was very seriously diseased. In a weak chain, the weakest link having given way, an attempt was made to so repair it that it should no longer be weaker than the rest of the chain. The result of the operation was a failure, but a failure which came near being a success. The closure persisted for two weeks and then only about one-third of the line of union gave way. The case was most unfavorable; the arterial wall was markedly degenerated; the line of suture was absolutely unsupported by surrounding structures and lay exposed in the cavity of a false aneurysm, and yet apparently success was nearly attained. This failure encourages one to

hope that under more favorable circumstances success may be confidently expected and that perhaps in some cases of sacculated aneurysm of the abdominal aorta it may be possible to open the aneurysm sac, close the opening in the aorta, support the line of suture by obliterating the sac by means of sutures and so make the weakest point in a weak aorta as strong as the rest of the vessel.

## ANEURYSMORRHAPHY.

PERSONAL EXPERIENCE WITH THE MODERN METHOD OF TREATING ANEURYSM.\*

BY ROBERT ABBE, M.D.,

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THIRTY years ago, it was considered safest to cure an aneurysm by arresting its blood current by digital compression, for a sufficient time to fill it with solid clot. It was common practice for the college professor to call for relays of volunteer medical students, to compress a femoral artery under thumb or finger pressure, for two days or more, until the aneurysm was solidly clotted. My personal experience as a student on two such occasions, gives me a lively remembrance of the tediousness of the method. Ligation by silk in those pre-Listerian days, resulted too often in fatal hemorrhage by ulceration of the vessel. Subsequently, antiseptic ligation held the field almost exclusively. One idea dominated the whole teaching of treatment, namely, the successful filling of the sac by clot, which subsequently "organized" and shrank. By organization was meant fibroid change with slow vascularization extending into the clot.

Ten years later, the theory of thickening and stiffening the resisting wall of the sac, by induced inflammation and cell proliferation was advocated, and its use put to the test in aortic, innominate and other inoperable types of aneurysm. The theory of building up and fortifying the wall from within, soon became accepted as an available method and new hope was excited. In 1886 and '87 the introduction into the sacs, of silver and steel wire, or of silk thread, was advocated, with the double purpose to induce clotting and irritate the sac lining. About the same date, puncture of the wall, by electrolytic needles, using a sharp current to excite inflammation had many

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\* Read before the Section on Surgery of the New York Academy of Medicine, March 6, 1908.

FIG. 1.



Aneurysm of the gluteal artery, filling the sciatic notch, grave neuralgia from sciatic pressure. Cured by matas operation.



advocates, and considerable success. Even Macewen's later method of scratching the lining with long hatpins, transfixing the sac, was based on the same theory.

Proliferation of the endarterial coats, was the keynote of the success of these methods. I myself had at this time two extremely interesting aneurysms of the aortic arch, into whose sacs I introduced, through a hollow needle, once, a hundred feet of sterile catgut, and again one hundred and fifty feet of fine steel piano wire, exciting its cells by electric contact for an hour (the opposite pole being at the back). Much was gained, as had been in the hands of others, the reports of which I incorporated in a paper (*Med. News.*, *Apl.* 9, 1887). Some patients so treated survived several months. Autopsy occasionally showed the wire buried in the densely over-grown aneurysmal wall. In Loreta's case, in the abdominal aorta, the sac closed tightly round six feet of silver wire, and in healing, compressed it into a small mass.

Two facts were demonstrated by these valuable contributions to our surgical knowledge of aneurysm: First, that the sac wall, if irritated, can be made the important factor in curing aneurysm; second, that where the tumor is large, the endarterial lining is considerably replaced by cellular tissue and the thinned out lining is too far gone to be available,—failure by such method is sure. In the case of Loreta's aneurysm of the abdominal aorta, there was no dissecting into outside tissues, but it had a complete endarterial lining,—hence fine plastic repair under wire excitation.

This demonstration of the value of the reparative building up of the aneurysm wall, rather than relying on clot filling alone to cure an aneurysm, prepared the surgical world to receive the new method of Dr. Matas.

I was able to employ it first in May, 1905, in a popliteal aneurysm of considerable size, which had been giving much pain from nerve pressure.

It was a simple matter to have the femoral artery compressed during the operation, and then on splitting open the sac, through a vertical skin incision, I found its walls were

eccentric to the artery, strong and continuous on the side toward the joint, but thinned out posteriorly. It was not difficult to place a fine chromicized catgut suture at the open mouth of the artery, and suture the walls together by continuous stitch from above downward, till the sac was entirely closed. One branching vessel opened into its lower half and was included in the suture. The same thread was continued into the overlying fascia and subcutaneous areola layer. A compress dressing without much pressure, gave primary union, and the case was perfectly cured without the slightest peril to the circulation of the foot. Prompt relief of pain followed.

Two things impressed me as especially gratifying: I left the work with no anxiety that I might have cut off a single superfluous drop of blood from the foot, as I might have done had I tied the femoral; and I felt that no recurrent anastomosis by the lower open mouth vessel which I sutured, could continue the dissecting action of the aneurysm. This I had once seen in a similar case after ligation.

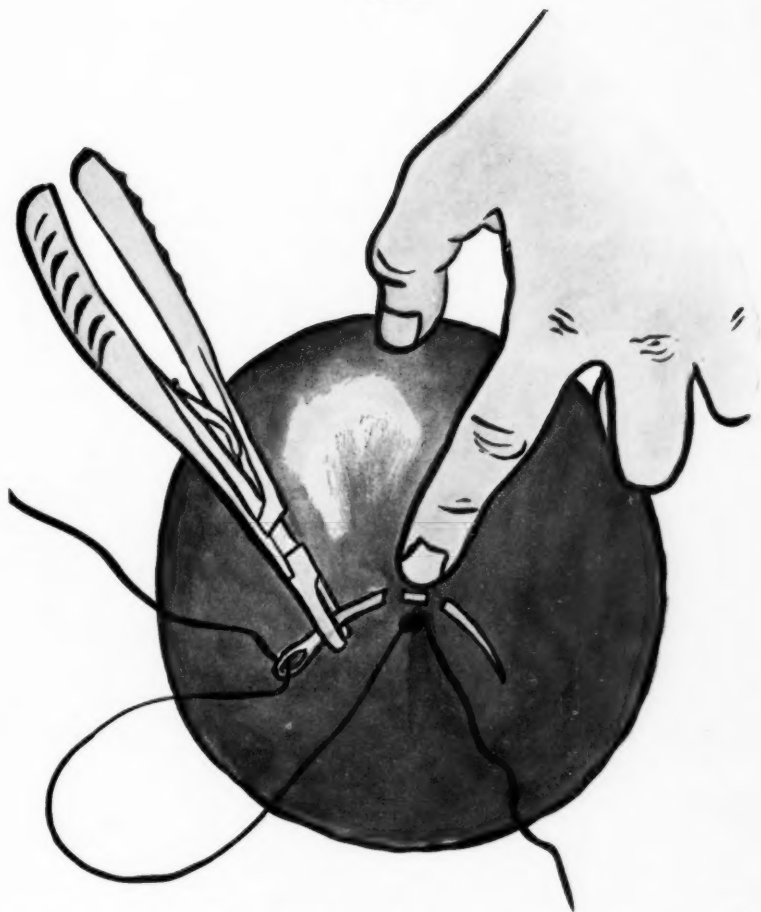
With this experiment I was prepared to apply the method to my second case, where it was peculiarly available.

A young Russian of 24 years had been developing for three months, right sciatic neuralgia with disability in walking, and some swelling of his foot. A pulsating tumor of the right gluteal region prevented his lying on that side also. The man had never had syphilis, but acknowledged gonorrhœa. His heart showed a blowing aortic murmur. Examination showed a spherical, pulsating tumor, three inches in diameter, beneath the gluteus muscle at the sciatic notch, where its pressure had caught the sciatic nerve, and held it tightly against the bone,—hence the neuralgia.

It was a particularly good case for operation by the plastic method, because ligation of the external iliac, while it would temporarily arrest the current, would allow free anastomosis and possible return; meanwhile leaving the distended sac to continue sciatic pressure.

On May 21, 1906, I opened the iliac fossa and threw a temporary silk ligature about the external iliac artery, which was held

FIG. 2.



Internal aspect of aneurysm, finger tip covering gluteal artery opening. Commencement of internal occlusive suture.



as a loop by my assistant, Dr. W. S. Schley, who drew it up against his index finger-tip, so as to avoid crushing it by tight ligation. This compression at once stopped pulsation in the tumor. I then incised over the tumor, and separated the gluteus. The sac was well distended and easily isolated. Its neck filled the uppermost corner of the sciatic notch (Fig. 1). On compression, after the pulsation had been stopped from above, it emptied, and quickly filled again. By inference, this must have been by anastomosis, as this iliac artery was quite occluded by the silk loop.

Seeing no way to keep it entirely empty; I ventured to cut it freely open, and relied on instant internal pressure to stop loss of blood. I first plugged the opening of the gluteal artery with my index finger-tip, and found no other bleeding occurred. I was then able to dry its walls and see that they were firm, with good serous lining. On releasing my finger pressure ever so little, a sharp flow of blood followed, but not in pulsating current. I now began a continuous suture of the internal wall, with fine chromicized catgut, first fixing it by a knot just above my finger-tip (Fig. 2). The next stitches were placed so as to catch in the sac wall, on both sides of my finger-tip, which I drew back as I quickly tightened them, thus sealing up the deepest part of the funnel-shaped cavity. After placing the first four deep stitches there was no bleeding, and I leisurely secured one wall against the other by continuous back and forth suturing, with the same thread. I even continued this until I had obliterated the entire sac, and closed the super structures, with no additional knot. The silk thread was removed from the iliac. The wound was bloodless. The patient made an immediate recovery.

Here we have a brilliant illustration of the reliance to be placed on the plastic union of opposing walls of an artery, held in contact, and irritated by the needle puncture and thread. This patient had no recurrence of tumor or sciatic pain up to three months after operation.

The question arises, as to how large an aneurysm we may venture to treat by this method (and how near the aorta). My own conviction is that it may be applied to any artery up to the innominate. If a firm clamp compresses the artery, we will say the subclavian, proximal to the aneurysm, the operator

can leisurely and surely occlude the sac. I can see little difference in the detail from that just narrated, and no reason for failure. I am prepared to go further and say, that if a suitable case of aortic aneurysm in the abdomen presented itself, it would be justified to combine this valuable method with one illustrated by me in 1894 (*New York Medical Journal*). We then showed the effect of introducing sterile glass tubes, of sizes suitable to the artery, into the lumen of divided vessels, and tying the arterial wall over each end of the tube, the latter being filled with salt solution, just before letting the current resume its course through it. I did this in a cat after cutting the abdominal aorta across, and four months afterward showed a fine healthy, and happy cat on this very platform, with the glass tube healed solidly into her aorta, the plastic exudate buried the tube, and the blood flowed for days through it, until at last the tube excited endarteritis, and occlusion resulted. Meanwhile, collateral circulation had ample time to be established. There seems to be no reason why an aortic aneurysm, below the superior mesenteric, might not be so treated. The current being arrested by strong pressure against the vertebra, the sac might be split, a tube inserted and tied in at either end; and a suture of the aneurysmal wall made tightly about the tube. It is probable that solid closure of the whole track would take place in a week, and occlusion of the aorta above and below be effected, as in my cat, by endarteritis from the presence of the tube. Meanwhile, free anastomosis would surely be established to the lower limbs. That situation is rare for aneurysm, but many cases are recorded, and the aorta has been actually ligated a number of times, in despairing hope of anastomosis, as published by Dr. Keen. The new plastic method may yet triumph.

Surgeons owe Dr. Matas high tribute for perfecting and advocating the technic of his method. The saddest side of this subject is, that, just as we have so promising and scientific a demonstration offered to the world, aneurysms seem to be going out of fashion.

## ANEURYSMORRHAPHY.

A CASE OF POPLITEAL ANEURYSM PRESENTING UNUSUAL DIFFICULTIES IN THE APPLICATION OF THE MATAS OPERATION.\*

BY JOSEPH A. BLAKE, M.D.,

OF NEW YORK,

Surgeon to Roosevelt and to St. Luke's Hospital.

W. M., a negro, forty-one years of age, was admitted to Roosevelt Hospital in April, 1905, suffering from a popliteal aneurysm. Its development had been rapid. Five weeks before admission he had noticed pain; a week later a swelling appeared which increased rapidly in size and in two weeks began to pulsate. The stiffness from the swelling and the pain became so marked that he could not walk. There was no history of lues or other etiological factors. Examination revealed a swelling the size of a duck's egg, in the right popliteal space, pushing the hamstring tendons aside. There was visible pulsation and a loud systolic bruit and thrill. There was no other evidence of endarteritis. The second aortic sound was accentuated. The lungs and abdomen were negative.

At the operation hæmostasis was secured by an Esmarch bandage, and an incision four inches long was made directly over the sac and carried down to it. The vein was found flattened over it and was retracted to one side. The sac was then opened for its full length and was found to contain a considerable amount of laminated fibrin. After its interior had been inspected, it was found that the aneurysm was a sacciform one. The communication between the artery and the sac was about one inch long and was situated less than one-half inch to the outer side of the incision in the sac, the artery, therefore, lying on the superficial aspect of the sac. This relation was wholly unsuspected until the sac was opened, there being nothing to indicate it in the appearance of the sac in the bottom of the wound.

Although under ordinary circumstances the case would have

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\* Read before the Section on Surgery of the New York Academy of Medicine, March 6, 1908.

been one admirably fitted for a restorative Matas operation, the propinquity of the incision to the orifice of the sac rendered this procedure impossible. In fact the artery being on the side of the sac toward the operator, rendered the introduction of any sutures exceedingly difficult. However, it was possible to close the communication fairly effectually with a single row of chromicized catgut sutures which, at the same time, considerably narrowed the lumen of the artery. It being impossible to make the suture line more secure, the artery was ligated on the proximal side of the aneurysm. The Esmarch bandage was then removed and the suture line was found to be efficient enough to prevent the reflux from escaping. A few catgut stitches were introduced to obliterate the cavity of the sac and the wound closed without drainage. A moulded plaster splint was applied over the dressing. The stitches were removed on the sixth day, healing occurring per primam. Three months later there was no sign of recurrence.

If one had suspected the relation of the sac to the artery, it might have been possible to have isolated it and rotated it out so as to have made the incision in it opposite its origin. Yet, isolating the sac would have defeated one of the objects for which the Matas operation was devised, namely, the conservation of the tissues and vessels about the sac, which are so apt to be injured in an enucleation. The superficial position of the parent stem made its ligation easy and although it prevented restoration of the vessel, it was analogous to the closure of the opening of the vessel into the sac by suture, as done in the Matas obliterative operation. This case, therefore, may be considered as a partially obliterative and restorative operation, in that the proximal communication with the aneurysm was closed while the continuity of the vessel below that point was restored.

It is a question whether a typical restorative or reconstructive operation is indicated for popliteal aneurysms, since the constant flexing of the joint submits the vessel to much traumatism. It would seem to me that on theoretical grounds the obliterative operation is best. That there is some ground for this opinion is shown by the fact that the only relapses

that have been reported from the Matas operation have followed reconstructive operations upon popliteal aneurysms. The restorative and reconstructive operations are, of course, only feasible in sacciform aneurysms. Even in these it seems to me that the obliterative operation is more conservative, for conditions demanding the preservation of the continuity of the vessel must be rare indeed. The possibility of thrombi, forming after the restorative and reconstructive operations, becoming detached and causing embolism beyond must be borne in mind, although, judging from the reports of cases, this accident does not seem to have happened other than after an obliterative operation. In this instance, gangrene followed an obliterative operation upon a femoral aneurysm, an embolus lodging at the bifurcation of the vessel. The only other reported instances of the occurrence of gangrene also followed the obliterative operation, but were due to injury to the vein and not to the interruption of the artery. There seems to be a general impression, based upon a faulty conception of the principles of the Matas operation, that its main purpose is the conservation of the continuity of the vessel, while in reality it is the least important feature of the technic. This impression is probably due to the natural desire to accomplish the wonderful rather than be satisfied with the more prosaic, although more effectual.

Although my experience has been gained from this one case, and although it was in a way unsatisfactory, I feel that the operation is simple. It is hardly necessary for me to say that it is based upon sound principles and is effectual, for this has already been proven by the brilliant results obtained in the hands of a number of operators, none of them reporting more than a few cases.

## THE SEROUS COAT OF BLOOD VESSELS COMPARED WITH THE PERITONEUM.\*

BY ROBERT T. MORRIS, M.D.,

OF NEW YORK,

Professor of Surgery at the New York Post-Graduate Medical School and Hospital.

It seems to me that the most important part of our new surgical work with blood vessels in general, and much of the old work with aneurysm in particular, depends upon the similarity of the serous coat of blood vessels to the peritoneum. The serous coat of blood vessels, like the peritoneum, throws out plastic lymph promptly for purposes of repair. The surfaces when irritated and brought together have a tendency to adhere, and septic processes in the serous coats of blood vessels give rise to many of the changes which occur in the peritoneum under similar circumstances. If the serous walls of an artery are merely brought together by a ligature, occlusion occurs quite as promptly and more safely than if the ligature is tied so tightly as to cut one or more coats of the artery. Torsion of blood vessels also causes such quick plastic occlusion from the serous surfaces, that arteries of the third class even may frequently be treated in this way, instead of by ligature. The methods of treatment of aneurysm by digital pressure, by the introduction of coils of wire, or by the introduction of electric needles, in the same way lead to rapid exudation of plastic lymph from the serous coats, and this exudation results in causing adhesion of opposed surfaces, or the lymph coagulates from the serous surfaces proceed to engage the coagulates of the blood in the aneurysm in such a way as to cause rapid clot formation.

The new work in the suturing of blood vessels depends for its safety upon the prompt plastic repair of the serous coats. The new work in aneurysm brought forward by Matas gives us a striking object lesson bearing upon this kind of repair.

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\* Read before the Surgical Section of the New York Academy of Medicine, March 6, 1908.

At the same time, may we not take a warning from our experience with the peritoneum? When we first began to appreciate the promptness of repair which was carried on by the peritoneum, it was given an exaggerated value which led to mistakes. In the abdominal incision the peritoneum was sometimes drawn up between the muscular layers of the abdominal wall in such a way as to insure immediate closure of the opening; but with the danger of absorption of the products of plastic exudation in a short time, leaving the muscular and fibrous structures unrepaired, owing to the mechanical obstacle to repair which the surgeon had introduced. In our work with aneurysm, in which the construction of patent channels is contemplated, we must remember this lesson from our experience with the peritoneum. In our suturing of blood vessels generally we must remember that a weak point will be left at the site of the slightest depression of the serous coat, unless the other coats are treated in a way to fortify the weak point. There seems to be no doubt that Ziegler in his text-book on pathology was the first to liken the interior of a blood vessel to that of a serous cavity. The growth of the tunica intima after ligation he compared with the plastic inflammation of a serous membrane. Ballance and Edmunds in their "Ligation in Continuity" 1891, seem to have disputed for the first time the claim that endothelial surfaces unite with difficulty when brought in contact, and they made experiments which showed that most endothelial surfaces adhere with very little provocation. On the other hand, Meigs in his "Human Blood Vessels in Health and Disease" 1907, tends to upset what we are now building upon. He states that there is no endothelial layer which is commonly present in the human arterial system. Perhaps the presence of a fine endothelial layer, or its absence, has no necessary connection with the reparative processes carried on by the tunica intima. Practically, however, we seem to be dealing with an endothelial layer in blood vessels, which acts very much like the endothelial layer of the peritoneum. Delbet in 1906 quotes the experiment of Jensen in 1903, when a steril-

ized piece of catgut, traversing both walls and the lumen of the main carotid, was found after eighteen days to carry no trace of a clot, but that portion of the catgut which was free in the lumen of the artery was swollen at the ends and evidently covered with endothelium.

The idea that arteries can be sutured was first conceived by Lembert, about 1750, and Hallowell, under the direction of Lembert, closed a punctured wound of an artery by a winding suture, successfully. In 1772 Assmann made four experiments with winding sutures on the femoral arteries of dogs, and the animals, killed six weeks later, were found to have the arteries obliterated. There was no more vascular suturing done from that time until the development of asepsis, about 1882. Delbet impresses the point that in suture of blood vessels we must remember that everything excepting blood, in contact with the serous coats, is a foreign body, and that the endothelium resents intrusions. He states that the two conditions absolutely necessary for successful work are asepsis and integrity of endothelium. Thrombosis which forms at the site of suture is due to infection. In aseptic work, the ferment thrombi produced by leucocytes and coagulates are not formed. Small wounds in the endothelial coat, and foreign bodies, including toxins, may produce small coagula which tend to enlarge, then to contract, finally to obliterate the blood vessels. The endothelium has a strong tendency to proliferate, but a very little septic infection arrests this proliferation in blood vessels as it does in the peritoneum. The rapid multiplication of endothelium is probably able to arrest coagulation. Delbet in 1889 studied the influence of antiseptic solutions upon peritoneal endothelium and vascular endothelium, and found that the latter was more sensitive than the former. Proliferation was hindered to such an extent that antiseptic solutions were shown to actually prevent healing of arterial wounds. This observation is one of great importance for our consideration in the new work with the arteries. Petit and Jensen demonstrated the harmlessness of aseptic sutures. Etling has never seen any evidence of thrombosis or inflamma-

tion at the site of aseptic tears of the tunica intima, but he has seen proliferation of endothelium at the lower edges of wounds and necrosis at the upper edges, so that in spite of efforts at repair, slight depressions were left. Blood pressure acting upon such slight depressions would have a tendency to develop aneurysm, although Peyton in 1907 sums up the whole subject of aneurysm as a matter of the middle coat alone.

In conclusion, I wish to impress the point that in our new surgical work with blood vessels in general, and with aneurysm in particular, we are to consider the serous coat of blood vessels as acting like the peritoneum, in carrying on immediate repair. We must be even more careful about leaving depressions of the tunica intima without fortification, than we need be in leaving depressions of the peritoneum, for the reason that the blood current will take advantage of such depressions more quickly and more continuously than is done by intra-abdominal organs.

In a case which I reported previously in the *ANNALS OF SURGERY*, temporary cure of a very large popliteal aneurysm was obtained by transforming the sac into a canal similar to the original artery. Recurrence of aneurysm began later at the site of a small depression apparently, and continued to increase from that point, although the greater part of the sutured area remained strong. I mean to suture other large aneurysms,—even of the aorta, if such a case comes for treatment, but the little pit in the tunica intima is the one into which we are likely to fall, in this new sort of work.

## LIGATION OF THE LEFT COMMON ILIAC ARTERY.

WITH REPORT OF A RECENT CASE.

BY WM. J. GILLETTE, M.D.,

OF TOLEDO, O.,

Professor of Abdominal and Clinical Surgery in the Toledo Medical College,  
Surgeon to Robinwood Hospital.

So few cases of ligation of the common iliac arteries have been reported that the one here presented seems to me to be of sufficient interest to be placed on record.

Prof. Z., in April, 1905, was referred to me for examination and advice by Dr. W. A. Dickey, of Toledo, and Dr. F. M. Firmin, of Findlay, Ohio. He was 56 years of age, of American birth and had been many years a prominent educator in the State.

About seventeen months prior to examination, he had a severe fall, and a short time after noticed a small pulsating tumor in the left buttock, probably arising from the sciatic artery near its exit through the sacro-sciatic foramen. It had recently been rapidly increasing in size until the pulsation could be felt over almost the entire buttock. Aneurysm was apparently present and operation advised.

On April 22nd I operated at Robinwood Hospital. The size of the aneurysm was such that successful ligation of the artery above it and below its exit from the pelvis seemed extremely improbable. For this reason the abdomen was opened and the left internal iliac artery ligated near its division from the external.

The patient made an uneventful recovery. Pulsation ceased entirely, and the mass rapidly diminished in size. A complete and satisfactory cure was thought to have been accomplished; but seven months later pulsation was again noticed in a small enlargement arising from the former site of the trouble. Immediate operation was again advised, but was deferred for nearly three months, when the mass had increased very considerably, but had not reached anything like its former dimensions.

On April 18, 1906, at the City Hospital in Findlay, with the assistance of Drs. F. M. Firmin and H. L. Green, I dissected down to the pulsating tumor in the buttock, thinking to ligate

the artery above it; but the farther I continued the dissection, the larger the sac grew and it was found to be absolutely impossible to ligate healthy artery outside the pelvis; neither was the Matas operation feasible.

The abdomen was again opened and compression made on the external iliac, with the idea that the blood supply of the aneurysm might come from some unusual branch of that artery, inasmuch as the internal iliac had already been occluded. A deceptive cessation of pulsation in the aneurysmal sac appeared, and the artery was quickly ligated; but to our amazement on re-examination of the tumor, we found pulsation had not been affected in the least.

Nothing was now left to do but ligate the common iliac and this was accomplished with some difficulty. A silk ligature was placed around it and tied close to the bifurcation of the aorta. Pulsation in the tumor now ceased entirely and the abdomen was closed. Through the incision in the buttock first made, the sac was freely opened, a large blood clot turned out, and the collapsed walls tied off at as high a point as possible.

Within three days the leg below the knee began to show signs of gangrene which soon fully developed, and on April 24th it was amputated at about the junction of the upper and middle thirds. The flaps promptly sloughed and reamputated, on May 16th, at a point about six inches above the knee. The wound now rapidly healed as did the incision in the buttock.

When the abdomen was reopened, incision was made in the line of the old one, to which a portion of the large intestine had become cemented and unfortunately a small opening was made into it. This was closed and no trouble expected from it; but a week later, a nurse, in giving an enema, found water escaping through the abdominal incision, and an annoying fecal fistula developed. This soon closed spontaneously.

Recovery, though slow, was complete, and in September the patient resumed his arduous duties as Superintendent of the public schools of a large city.

A résumé of the literature of ligation of the common iliac artery shows that this operation has been very infrequently performed, and that the death rate following it has been and is yet, very high; also that gangrene of the leg is of frequent occurrence, and beyond the power of the surgeon to prevent.

Carl Dreist of Strassburg, in 1903, published a paper in the *Ztschr. für Chir.*, compiling all the cases found in the literature up to that time. In reporting these cases he adopted the classification of Kümmel, placing them under four heads; first, those that were performed only for the purpose of checking hemorrhages; second, to cure aneurysms of large vessels; third, to devastate vascular pulsating tumors; and fourth, to prevent bleeding during extirpation of tumors or exarticulation of the femur.

He found that fifty-nine cases had been operated prior to 1880, or in the pre-antiseptic era; and since then, until 1903, he was able to find reports of nineteen more.

In addition to the cases reported by Dreist, in a search which I had made in the Surgeon General's office at Washington, I have been able to add one more which was reported in the *British Medical Journal* in 1903, pages 77 and 78, by Arthur H. Martin, in which a private in the late Boer war received a bullet-wound in the left groin and an aneurysm of the left iliac artery developed, for which ligation of this artery was done with recovery.

A summary of the cases reported, including my own, would show that the iliac arteries have been ligated all told eighty times, with fifty-six deaths, or a death rate of 70 per cent. over all; that fifty-nine of these operations were done prior to 1880, during the pre-antiseptic era, with forty-six deaths, or a death rate of 77.97 per cent.; and that in the twenty-one operations done since 1880, presumably with aseptic precautions, there were ten deaths, which shows a reduction in the death rate to 47.64 per cent., a very decided improvement. Gangrene of the leg has occurred in the last twenty-one cases seven times, or in  $33\frac{1}{3}$  per cent. In the fifty-nine cases prior to 1880, the same number, seven, with six deaths were reported. This is probably an error; for no doubt there were many more.

Dreist says very truly that although the death rate has been lowered in later times by aseptic methods, the operation is still a dangerous procedure, and should only be employed in the presence of the gravest necessity.

## THE QUESTION OF OPERATION FOR NON-PENETRATING INTRACRANIAL TRAUMA.\*

BY JOHN A. HARTWELL, M.D.,

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NON-PENETRATING injuries of the cranial contents may be divided into four classes in their consideration from a therapeutical standpoint. First—Those in which the injury is so slight that recovery is certain without operation. Second—Those in which the severity of the injury is so great that death is inevitable in a short time. Third—Those in which the injury is of such a nature that operation is positively indicated. And fourth—Those in which the indications for and against operation are more or less evenly balanced, the border-line cases. The first and second classes need but a brief consideration. In the first are included cases of mild or moderate concussion without gross anatomical lesions. The diagnosis of this condition usually offers no especial difficulty. As a rule, the inflicting violence is not very great. The patient loses, to a greater or less extent, consciousness; the face is pale, there is vomiting, muscular relaxation, including the sphincters, and a loss of tone in the blood vessels, causing sweating and feeble rapid pulse. The reflexes are usually at first diminished, and then exaggerated. The pupils are, as a rule, dilated. The respirations are shallow and rapid. The temperature is not elevated, and may be lower than normal. The course of the condition is toward recovery, and in a short time, with rest in bed, the administration of stimulating enemata, cardiac restoratives, and external heat, a marked improvement is noted. It must be remembered that this picture of concussion may be present as a complication in any brain injury, and may mask the symptoms of a more serious lesion. The more severe cases

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\* Read at a meeting of the New York Surgical Society, Feb. 26, 1907.

of concussion belong to class four, and will be considered there.

Under the second class belong those cases in which the damage to the brain is very extensive, or implicates the centres of the vital functions in the medulla. Extensive damage (of this sort) results usually from multiple fractures with large intracranial hemorrhage and laceration of brain tissue. The latter are occasionally seen without fracture. A localized injury involving only the medulla is, fortunately, rare, for death is almost instantaneous. The patients of this class present such a varied symptomatology, and their condition is one of such extreme shock, that no accurate diagnosis can be made. Death usually ensues within a few hours, and no treatment is indicated, other than the means usually employed to combat the shock. This, however, should be done energetically and consistently, because it occasionally happens, that the brain damage is not so great as the shock indicates, and recovery is possible.

The class of cases in which operation is plainly indicated, and that class where its value is doubtful, are of especial interest. In deciding for operative interference in any case of intracranial injury, certain well founded principles have been formulated in the past, and our present knowledge in no way alters them. First—An accurate diagnosis of the pathological lesion existing must be possible. Second—The possibility of relieving this condition must be present. Third—The operative violence in accomplishing this must not be excessive. And fourth—It must be reasonably certain that complete recovery will not take place without operation.

Cerebral localization has made great advances through the work of the physiologists, neurologists and pathologists during the last decade, and accurate diagnosis is accordingly advanced. In dealing with a trauma, however, considerations arise which are not present in brain tumor and abscess, namely: those due to the general concussion and to the possibility of multiple brain injuries being present. For these reasons, the advances in localization are not of so great value in working

out the problems presented by our subject, as they are in a more circumscribed pathological lesion.

A careful analysis of all non-penetrating intracranial injuries shows that only two sub-groups can be properly made under classification three, where operation is positively indicated. The first of these is when the brain injury is due to a direct damage to the brain by a depressed fracture, and the second, the classical middle meningeal hemorrhage, or hemorrhage from a cerebral vessel directly affecting a sensorimotor area. In the first sub-group the procedure of dealing with the fracture and the underlying brain injury is well established along definite lines, and needs no elaboration at this time. Emphasis must, however, be laid on the necessity of exploring every suspected fracture of the calvarium, even though no evidence of actual brain injury is present, for such injury may exist in the absence of symptoms and late epilepsy often supervenes on such a condition.

The clinical picture in the second sub-group is usually well defined, and rarely is a diagnosis not made. The history of the injury, followed, usually though not invariably, by longer or shorter periods of concussion, then freedom from symptoms, with the later onset of compression, muscular contraction and paresis on the opposite side, are too well known to require any comment. Operative interference in all cases of these sub-groups is positively indicated. The following case of Dr. Gallaudet, by whose courtesy I include it, is an excellent illustration.

CASE I.—Admitted to Bellevue Hospital on November 27, 1907, in the service of Dr. Gallaudet, with the history of having received a fist blow over the left side of the head the day before. He was not rendered unconscious, but almost immediately became aphasic. On admission he was aphasic, and showed a right-sided paralysis of the arm and face. Operation showed a stellate fracture with extra and subdural hemorrhage, as well as hemorrhage in the brain cortex over the area indicated by the symptoms. Recovery.<sup>1</sup>

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<sup>1</sup> For a full report of this case by Dr. Gallaudet, see page 122.

The following cases, however, show the difficulties which may arise, and the caution which is needed in drawing conclusions.

CASE II.—*Trauma over left parietal region from falling timber. Subdural hemorrhage over right precentral convolution with late development of irritation and pressure symptoms. Operation with recovery.*

A man, aged 49 years, colored, was admitted to Lincoln Hospital on Feb. 27, 1906, with the following history: On Feb. 21st he was struck on the head by a large piece of timber falling from a height of one or two stories. He was knocked to the ground, was picked up unconscious and taken to a hospital in an ambulance. He regained consciousness in about twenty minutes, but was excitable and irritable. There was a large scalp wound over the left parieto-temporal region. This was sutured. He continued in his irritable and rather unmanageable condition during the next six days, without, however, manifesting any local cerebral symptoms. In addition to his irritability, he had several attacks of vomiting. He was taken home against advice. On his admission to Lincoln Hospital, six days after the injury, the following notes were made: Patient has a healed scar on the left side of his head, six inches long and curved like an operative incision. Patient seems drowsy, yet at intervals he is irritable, restless and unmanageable, trying to get out of bed. Patient does not respond to questions, and on being aroused looks at one with a vacant expression. Heart, lungs and abdomen all normal. Extremities: no change in sensations apparent. No paresis or paralysis. Reflexes: markedly increased. Control of bladder and rectum perfect. No change in pupils. Shortly after admission patient had a convulsion, which was reported by the attendant to be general in character.

During the following three days the convulsions were repeated several times, were of very short duration, and no evidence that they were at all localized could be obtained. On March 2nd these convulsions began to occur with great frequency, about every twenty minutes, for periods of an hour at a time, followed by a period of rest. They were becoming longer in duration, and the following notes on their character were then made: There was a vacant staring expression of the eyes, with a gradual conjugate deviation toward the left; after four or five seconds, there was a tonic contraction of the muscles of the left side of the face,

then a drawing of the head downward on the left shoulder, with an elevation of the latter; then tonic contractions in the arm, and then in the leg of the left side. This phase occupied about fifteen seconds, and was followed by clonic spasms of the same parts and in the same order. The whole convulsion lasted from sixty to ninety seconds, during which time the patient was totally unconscious. He then gradually regained consciousness and the contractions ceased. At this time, when he had altogether about twelve convulsions, he for the first time showed a decided left facial paralysis, and marked weakness of left arm and leg. This was on the ninth day after the injury, the first convulsion having been noted on the seventh. On the eighth day his condition had apparently improved. Operation was performed on March 2nd, nine days after the injury, and as soon as the localized character of the convulsion and the paralysis was evident. Under ether, a curved incision was made just above the right temporal ridge, about eight inches in length, and carried directly down to the skull, the flap being turned downward. The fissure of Rolando was now marked out, and a trephine opening was made over the face centre, in ascending frontal convolution, and enlarged upward with the rongeur, to an area of about two inches in diameter. The dura showed no pulsation, and a clot could be seen beneath it. Dura was divided around the line of the bone opening, and a large organized clot was removed from the cerebral cortex. Electrodes applied to the facial centre produced a prompt contraction of the muscles of the face on the left side. No response could be obtained in either of the extremities, possibly because the nerve cells here were too much damaged, and inspection indicated that the cells for the arm were more damaged than those for the face. The opening in the skull was not extensive enough to reach the leg centre. The dura mater was closed with catgut sutures, a small rubber tissue drain put down through it, and the scalp sutured back in place. It was noted that the scalp was quite oedematous, probably due to lymphangitis following the original scalp wound.

Post-operative notes: March 4th—Recovered from anesthetic without incident. Slightly excited during first twelve hours, and then became rational, but continues rather stuporous. Can be roused and gives correct account of injury, and other details of his residence, work, etc. Still has considerable weakness of

left upper extremity, and less of the lower extremity. Is able to make coordinated movements. Slight spasticity of left lower extremity, none of upper. Left-sided facial paralysis, and left deviation of tongue. Upper branch of facial less paralyzed than lower. Examination of reflexes unsatisfactory. No oculo-motor paralysis. March 6th—Patient less rational than formerly. More stuporous. Complains of pressure on head. Very restless. Left arm can be moved only with great difficulty. Face more markedly paralyzed. Wound examined and pus found along the suture line. Considerable distension. Opened after stitches were removed. Infection all through the scalp, due to previous lymphangitis. Pus infiltrating tissues down to the dura. Dura thickened, and brain apparently well walled off by dense adhesions. Wound area opened up widely and dressed with free drainage and bichloride solution. March 9th—Wound very much cleaner. Both sides granulating well. In centre, still suppurating. Left arm can be moved more freely. March 11th—Wound granulating well. Patient more rational. Movements on left side stronger. March 13th—Patient improves slowly. Mind brighter. Movements of left side gradually returning. Can put left hand to mouth and nose with effort. Cannot hold up a single finger of his left hand. March 15th—Wound granulating well. Pulsations fair. Complains of being in bed. Left facial paralysis less marked. Can nearly hold up finger of left hand. March 27th—Wound granulating well, nearly free from pus. Mental condition practically normal. Left leg can be used nearly as well as the right. Left arm not so powerful as right. Power of coordinated movements not entirely regained. With eyes closed, fingers do not meet by several inches. Left not so strong as right. Facial paralysis still slightly present on left side of face. Left eye cannot be shut tight. Left angle of mouth can be drawn back but a very little. April 10th—Patient discharged, forty days after the operation. Wounds entirely closed. Still showed slight incoordination of left side of body, and slight left-sided facial paralysis. He walks without any dragging of the foot. Mentally, he is normal.

April 25th—Eight weeks after his operation there was absolutely no evidence of his injury remaining except the scars on his head, and the brain pulsation beneath the opening in the skull. There is no evidence of any irritability of the brain due to adher-

ent dura. The patient was again seen on February 10th, 1908. The only evidence of his trouble is found in a loss of general strength and an irritability of temper. No paralysis or convulsions have developed.

The interesting point here was the late onset of localizing symptoms. He had been under observation in two hospitals for nine days, before any evidence on which to base an accurate diagnosis was available. And yet at operation a subdural hemorrhage was found directly over the motor area, on the side opposite to the injury. A case reported by Dr. Krauss, *Amer. Journal Medical Science*, Vol. 128, is the almost exact counterpart of this.

CASE III.—*Trauma over right parietal region from falling brick. Paralysis on right side. Operation on left side. Extra and subdural hemorrhage over right motor area. Death.*

Man, age about 30 years, was admitted to Lincoln Hospital May 19, 1906, with a history of having been struck on the right side of the head by a falling brick. Patient was rendered entirely unconscious and remained so on his arrival at the hospital in the ambulance. Examination at that time showed the following conditions: Patient entirely unconscious. Cannot be aroused. Pupils equally dilated. Do not react to light. No strabismus. No facial paralysis. Hematoma on right side of head over the posterior frontal area. Suggestion of a depressed fracture of the skull, but not definitely determined. No laceration of scalp. No bleeding from ears, nose, or mouth. Spine apparently intact. Chest normal. Pulse very slow, though regular. Second sound of the heart good. Pulse shows slight increase in tension. Lungs normal. Breathing varies. At times, Cheyne-Stokes in character, at other times it became stertorous. Abdomen normal. All superficial reflexes are delayed, though present. Knee-jerks present but not exaggerated. Cremasterics delayed. All extremities moved normally though hard to elicit on account of unconscious state. Sensations delayed but present. One hour later an incision  $2\frac{1}{2}$  inches long was made on the right side of the head, through hematoma down to the skull. No fracture discovered over the parietal bone anywhere on the right side as far as felt. One hour later, patient still entirely unconscious. Color good. Pulse slow but of good volume. Slight increase in tension. Breathing more regular and deep. Pupils: left slightly contracted, reacts to light; right dilated and does not react. *Right eyelid*

*partially paralyzed with a tendency to right facial paralysis.* Irritation with pin causes no response on right side. On left side of face causes shutting of eyelids and twitching. *Right arm and leg partially paralyzed*, though not entirely so. Some response to pin. Toes moved some. Knee-jerks absent on right side. Very slight on left. Cremasteries delayed on right side. Present on left.

Three hours later. Patient entirely unconscious. Supra-orbital pressure causes facial movement on the *left side*. Only slight on *the right*. Pupils: right dilated, left contracted. Neither reacts to light. No strabismus. No nystagmus. Pin pricking on whole of left side, including face and extremities, causes active movements on that side. Right side pricking causes movements of left extremities, with evidence of sensations but feeble movements of right arm, face, and lower extremity, those of the right thigh being a little stronger than those of the leg. Right knee-jerk exaggerated. Superficial reflexes of right side about normal. Knee-jerk of left side about normal. Superficial reflexes on left exaggerated. While eliciting cremasteric reflexes, patient voided urine and was apparently conscious of the act. Pulse still slow. Respirations labored and stertorous. Five hours after the injury patient was etherized. Head cleansed on table and a curved incision was made over left temporal region about in line with the temporal ridge. Incision down through all tissues to bony skull. Flap raised intact, and bleeding vessels caught and clamped. Flap turned down and covered with hot towel. Surface of skull exposed over left motor area (previous to incision by mensuration the motor area of left hemisphere was determined and the skull marked for arm area). Skull trephined. The dura appeared dark, but seemed to pulsate. With continuous saline irrigations trephine opening was then enlarged up and down, and to both sides, exposing an area about  $1\frac{1}{2}$  inches wide and 2 inches long. Dura rather dark, but brain pulsating. Large congested vessels in the dura. Incision longitudinal in character made through the dura and enlarged with scissors. Vessels of the pia mater exposed, greatly congested. No subdural hemorrhage. Brain tissue itself rather darker than normal, and under severe pressure. About the margins of the opening, brain appears better and more normal in color. Crucial incision now made in the dura, and brain allowed to bulge out fully half an inch.

Immediately, patient's breathing, which had been labored and stertorous previously, became quieter and deeper. Pulse found now to be increased in frequency, and more nearly normal rate. Character of brain area exposed, changed when left to bulge for a time. Central area in opening has several dark spots, as if intracerebral hemorrhage had taken place. Surface about margins became nearly normal in character. Bulging seemed to relieve some of the intracranial pressure. Puncture made through pia mater, but no fluid obtained. Slight venous oozing followed. Cerebral puncture disclosed no deep hemorrhage. Flap brought back, and with dura left open the entire tissues of the scalp were sewed back in place with continuous catgut suture. Rubber tissue drains inserted, and sterile dressing applied. Patient returned to ward and put in bed with head raised. Patient passed comfortable night. Still unconscious, though not deeply so. Breathing quietly. Pulse a little rapid. Slight movement present in right arm. Left hand had to be tied to keep him from tearing off dressing. Face flushed. Urine passed involuntarily in the bed. Slept part of the night.

May 20th.—9.30 A.M. Patient seems somewhat conscious. When name is spoken at times opens one eye and appears to hear and understand. 2 P.M. Face flushed. Breathing quietly. Pulse good with less tension. General condition remarkably good. Right pupil dilated, left contracted. Both react to light, though right, very little and slowly. Motor system same as yesterday previous to operation. Left side moved normally. Right leg, thigh and toes all moved slightly, thigh the most. The only difference is in the upper extremity, which seems more paralyzed than yesterday. To stimulation, only movement of arm elicited. Forearm and hand completely paralyzed. Right eyelid and face moved more than yesterday, though still somewhat paralyzed. Sensory, same response as yesterday. Heat, cold and pain tried. Apparently not so sensitive to heat and cold on left side as to pain. Right side not distinguishable. Right knee-jerk exaggerated. Left normal. Cremasterics, right not obtained, left normal. Superficial abdominal delayed on right, exaggerated on left. Bowels have not moved as yet. Active incontinence of urine. Mental condition improved. Patient seems to know his name and resists when catheterized. When pricked with pin, seizes hand pricking him with his left hand and mutters inco-

herently. May 22nd—General condition not so good. Mentally, more deeply unconscious. Left pupil dilated and does not react. Entirely paralyzed on right side. No response to pin pricks. Right knee-jerk slightly exaggerated, but not markedly so. At times has to be catheterized, at others has active incontinence. Deep pricking on right side of body and extremities produces movements of the other side of body. Not quite as marked as when the same prick is applied to left side. Knee-jerk right side lost. Cremasteric present. Left pupil reacts. Right pupil reacts slowly. Right axillary temperature 102.2 F. Left axillary temperature 102.6 F. May 23rd—Patient responds to name, and when asked questions mutters incoherently, though he seems to hear and partly understand. Paralysis on right side total. Sensation on right side dulled. Pin pricks cause very little movement on the opposite side. Left side sensations less marked. Left pupil contracted and reacts. Right dilated, and it also responds slowly. Patient breathes rather heavily and seems comatose most of the time. Urine passed involuntarily. Bowels have moved only with enemas. Sphincter control seems perfect. Reflexes: right knee-jerk lost, left present. Cremasterics present. These findings remained unchanged until death on May 25th.

*Autopsy.*—On removing skull-cap considerable amount of extradural soft jelly-like blood clot was found over the *right motor* area and temporosphenoidal lobe. None on the left side. On opening dura an extensive clot was found covering the lower half of the right ascending frontal convolution extending forward toward the frontal lobes. Just above Sylvian fissure, in front of Rolandic area, the clot was rather firm and the brain surface showed considerable pressure damage. Over operative wound, brain seemed entirely normal. Whole left motor area was entirely free from clot or evidence of injury, either extra or intradural. A small hemorrhage was found deep in the brain at the site of one of the needle punctures. No fracture of the skull found. Examination of the medulla showed a normal crossing of the pyramids.

This case illustrates a condition not infrequently observed, namely, the brain injury on the same side as the paralysis. Three explanations are given: first—a rare condition of uncrossed pyramids; second—a counter pressure on the opposite side from the hemorrhage against the bony wall, producing local-

ized pressure there which is not felt immediately beneath the soft cushion of the blood; and third—an error in observation, that is, the voluntary paralysis exists on the side which is moved when irritated, the movement being reflex; whereas, on the non-paralyzed side, no movement takes place, because the reflexes are inhibited by the normal cerebral influence. The latter seems the more plausible, though in this case the movements appeared to be voluntary in character. After the operation, his efforts to remove the dressings certainly could not be called reflex, and they were made powerfully with the left arm—that is, on the side where the brain damage was subsequently found—so that the arm had to be tied to the bed. Whatever the explanation is, the therapeutic procedure should be to open both sides of the skull in such cases. The neglect to do so here probably cost the patient his life. The muscular reflexes, as usually elicited, it will be noted, varied from time to time, sometimes being greater on the right side, and sometimes on the left. The variations in the pupil, too, were irregular and not to be classified, though as a rule they were of the Hutchinson type described below. These curious variations in reflexes are those reported by all observers, and emphasize the fact that clinically the teaching of physiology concerning the reflexes is of little value. Their confused condition in spinal injury has been the subject of much unsatisfactory study. This case is very instructive when considered in conjunction with Case II. The injuries were very similar in their nature, but the results were quite divergent. In Case II the hemorrhage was only subdural on the side opposite to the injury, and the paralysis was contralateral to the hemorrhage and slow in developing. In Case III the hemorrhage was both extra and subdural on the side of the injury, and there was a homolateral paralysis developing early. The late development in Case II seems to have been due to a chemical destruction of nerve cells by the changes in the blood clot, while the early development in Case III was undoubtedly due to the immediate effects of the pressure.

Loeb has shown that the cerebral cortex is not excited by the ordinary chemical stimuli which affect nerve fibres. This does not preclude the possibility, however, of a stimulation due to a change in the cells themselves when subject to a condition such as that found in Case II. No recent hemorrhage was present, and the pressure per se did not seem sufficient to cause the symp-

toms observed. Some of the cells, too, seemed inexcitable to faradism, which still further points to serious damage in their structure having taken place.

CASE IV.—*History of old trauma over left side of forehead. Symptoms of late abscess over left motor area. Operation without finding lesion. Death. Autopsy showed no brain lesion, but a condition of the kidneys suggesting acute uræmia as cause of symptoms and death.*

Man, age 28, admitted to Lincoln Hospital April 6, 1907, in an unconscious state, the following history being obtained from his family. Three years previously the patient was struck on the left side of forehead. Was unconscious from the blow for over twenty minutes. Recovered in a short time with seemingly no ill effects. About six months ago patient suddenly had trouble with his speech. Was unable to speak for a time. Attack similar to "petit mal." Would be all right the next day. Since that time he has never been quite the same. Speech thick and hard to understand. After succeeding attacks he seemed to become depressed in spirit, and at times acted as if he were drunk or drugged. About two months ago he was treated at this hospital for injury to left foot, from stone falling on it, causing a bursting laceration on the sole. Wound cleaned, drained and sutured. Healed up very rapidly. At this time he was considered mentally weak. He was brought to the hospital in an ambulance yesterday, while in an unconscious condition, and having convulsions, general in character. According to his wife, who found him in this condition, he had never had any attacks of this kind before.

Examination showed the patient to be well nourished. He was entirely unconscious, lying in bed with head turned to the left; eyes also drawn to the left. Pupils equal, regular, reacting to light. Eyes oscillate slightly and at times slight incoordination is seen. There is constant twitching of right hand, particularly middle fingers. Also twitching at times of right side of face, right leg, and whole right side of body. When twitching is most marked, left leg becomes involved. The temperature ranges from 100 to 103.5. Pulse 110. Respiration 25 to 30. Leucocytes 20,000. There was no paralysis noted, though the right extremities seemed weaker than the left. The picture here given is that of a late abscess following a trauma, and the great-

est point of irritation seems to be over the motor area for the face and arm in the left hemisphere. The conjugate deviation of the eyes is away from the side on which the extremities are involved, and not toward it, as is the rule. One discrepancy is noted. After twenty-four hours' observation, operation was advised and accepted.

*Operation, April 6th.*—The motor area of left hemisphere was determined, and the skull marked for arm area. A horseshoe shaped incision was made through all the tissues down to the skull, over left motor area, flap being turned down and protected by a hot towel. Skull trephined and opening enlarged with rongeur. Dura appeared normal through opening about  $1\frac{1}{2}$  inches wide and 2 inches long. Incision made in dura exposing cerebrum, just anterior to fissure of Rolando. Brain pulsating normally, no bulging, vessels in pia seemed enlarged, but membranes about them appeared abnormal, some places being pearly white, but mostly yellow. These areas small and opaque. The exposed area of brain was then thoroughly explored with needle in search of abscess, but with no result. Dura closed with catgut sutures. Flap sewed back in place with interrupted and continuous catgut sutures. Dressing applied. April 7th—Patient still in unconscious condition. Seemingly a little brighter. Pupils equal, dilated. Some drooping of left eyelid. Slight nystagmus. Eyes still drawn to left side. Pupils react to light, but sluggishly. Marked flattening of right side of face. Right arm flaccid with some twitching of hand, but not so continuous. Left arm rigid. No reaction to sensation or pain on either side. Right leg flaccid; purpuric condition on leg extending from ankle to upper third of thigh. No reaction to pain or sensation. Knee-jerk increased. Babinski present. Left leg rigid. Knee-jerk normal. No Babinski. Cremasteric reflexes absent on right side, present on left. Abdominal reflexes active. Dermographia all over body, marked on abdomen. April 8th—Patient had a general convulsion. Twitching in hand not present. Condition worse. Rise of temperature to 103.5. Very rapid small pulse. Breathing irregular. Has to be fed by catheter through the nose, and per rectum. Urine and feces lost in bed. April 9th—During a convulsion this morning, eyes were first noticed becoming incoordinated and drawn to right side, then twitching seen on right side of face, tetanic movements rapidly increasing, then extending to fingers

of right hand and arm, next the right leg was involved, then becoming general. Attack lasted about two minutes, dying out where it began. No increase in knee-jerk on right side. No Babinski. Death sixty hours after operation, with no change in condition last noted.

*Autopsy.*—The brain exposure was found to be exactly over the face and arm area. Nothing abnormal was found on the surface, either in the dura or the brain itself. Sections showed no abnormality other than those due to the needle puncture. At the end of one of these  $1\frac{1}{2}$  inches from the surface, beneath the arm area, there was a clot about  $\frac{3}{8}$  inch in diameter. Other smaller clots were also found. This is interesting as explaining in part the greater degree of paralysis after the operation. The kidneys showed a condition of acute degeneration which the pathologist reported to be due to a toxemia of some sort. There was no evidence of any chronic lesion. The possibility of the convulsions being uræmic, cannot be excluded, though previous to operation, and following it, urine was freely excreted. It contained considerable albumin and some blood, particularly just prior to death, but this was believed to have been due to his toxic condition. All the other organs were found normal, and no additional cause of death could be determined.

It is well known that uræmia may cause one-sided convulsions simulating a brain irritation. In this case, however, the history of the old head injury, the weakness on the convulsed side and the elevated temperature, with the leucocyte increase, all seemed to justify the suspicion of brain abscess.

CASE V.—*Unconscious alcoholic patient with head contusions. Convulsions on left side. Operation and death. Autopsy showed localized cortical softenings.*

Unknown man, age about 45 years, admitted to Bellevue Hospital September 27, 1906, from Harlem Hospital with a diagnosis of alcoholism. He was in coma most of the time, but soon after his admission it was noticed that he was having frequent general convulsions, one every hour or so. On Sept. 29th the convulsions became localized to the entire left side of body, each one lasting from one half to two minutes. In the intervals the left side seemed to be paralyzed. Complete examination at this time showed the man to be partially conscious, but unable to answer questions. He showed every evidence of

being markedly alcoholic. Supraorbital stimulation brought on convulsions of the left side of the body, eyes deviating to the right; pupils are equal and moderately dilated, and react normally. Pulse regular; fair force; moderate tension. Knee-jerks absent on both sides. Left upper and lower extremities paralyzed. Right extremities both moved voluntarily. No paralysis of face, but some convulsive twitching on both sides.

Examination of head shows general contusions and bruises over face and forehead. The case was considered one of probable alcoholic cerebral œdema, but the presence of contusions on the head, and the localized nature of the convulsions and paralysis, led me to operate rather against my judgment. Accordingly the motor area was exposed over the left hemisphere, and the brain found to be in a congested condition, and somewhat œdematous, but no localized process to account for the left-sided convulsions. Following the operation, the patient's condition was practically unchanged, and he died about two hours later.

*Autopsy.*—The brain was found to be markedly œdematous, with areas of circumscribed softening scattered irregularly over the cortex. This condition was especially marked in the first temporosphenoidal convolution on the right side, and in the angular convolution, both of which are situated well behind and inferior to the motor areas. Operation in this case was done on insufficient data. The element of an alcoholic cerebral œdema, with the localized softening, was given too little weight.

A summary of these four cases shows, one with distinct local hemorrhage over a motor area, giving no symptoms until the ninth day, and three with all the symptoms of a localized motor lesion, in which, at operation and autopsy, no such lesion could be demonstrated. Nothing could better illustrate the difficulties encountered in making an accurate diagnosis in these conditions, and the necessity of being cautious in deciding for operation.

There is left for our consideration the fourth group of our classification, the true border-line cases, and this constitutes one presenting even greater difficulties. A study of the manifold functions of the brain, its liability to serious injury despite its complete protection in the skull, its inaccessibility to the surgeon, and its delicate structures, reveals at once the cause of these difficulties. The cases coming under this group may be conveniently divided pathologically as follows: First—Serious con-

cussion. Second—Contusion, that is, multiple small lacerations of brain tissue and blood vessels. Third—A more extensive laceration confined to a limited area. Fourth—Hemorrhage not giving distinctly localized symptoms, that is, not causing irritation or compression over an area of known and demonstrable function. Fifth—A combination of two or more of the above. In the first sub-group, serious concussions, a careful study of the symptomatology will usually be rewarded by a correct diagnosis. There is, almost without exception, a history of an injury acting rather diffusely over the head, followed by immediate unconsciousness. Vomiting is present, but not of the projectile type seen in compression. The whole appearance is one of extreme shock, or collapse, except that the pulse, while soft and compressible to the vanishing point, is not always correspondingly accelerated. This condition lasts a varying time, and is *usually* followed by slow improvement, if the result of a pure concussion, without gross lesions. Occasionally, however, instead of recovery a new set of symptoms is ushered in. The picture then is more complex, and with the symptoms described above, there are mingled those of cerebral excitation. These are restlessness, irritability and increased reflexes. The patient resents markedly any attempt at an examination. Instead of improvement, he passes from this stage into one of deepening coma, and the slow, full high tension pulse, and slow deep respirations mark the onset of a condition of compression. This may, of course, be due to a hemorrhage, but it also develops without this when the disturbed tone of the blood and lymph vessels allows the transudation of serum to produce a brain oedema. The following case fully illustrates these points.

CASE VI.—*Diffuse head trauma. Concussion with later onset of cerebral irritation symptoms and compression. Decompression operation. Recovery.*

A boy, ten years old, was admitted to Lincoln Hospital February 4th, 1906, at 2 P.M. with the history of having fallen a distance of 20 or 30 feet, and landing on his head and shoulders. No one actually saw him fall, so that it was impossible to get accurate data on the above points. He was brought to the hospital by ambulance in a condition of considerable shock, and partial coma. He could be aroused with difficulty; surface cold and pale; temperature 99.2, pulse 120 and weak, respiration 32. There was

no paralysis. Pupils were dilated. No localizing symptoms of any sort could be made out. Examination of the head showed an extensive hematoma over vertex and left parieto-frontal region. No evidence of fracture could be made out under this hematoma. There was no bleeding from the ears, mouth or nose, nor any subconjunctival hemorrhage.

The child was put to bed, and the usual remedies for shock, including rectal irrigations and morphine, were given. In the course of an hour the shock had considerably lessened, and the coma was less deep. He continued to recover from the shock, but the coma again deepened, and the irritability on being aroused was becoming excessive. No coordinated response could be elicited in any way. He resented very markedly any manipulations, or any effort to make him answer questions. He failed to recognize his father. All the reflexes were markedly exaggerated, but no paralysis or anesthesia could be made out. His condition was diagnosed as one of severe cerebral concussion, with progressive changes in the cerebral vessels, and beginning oedema of the brain. Under ether anesthesia, two hours and a half after admission, incisions were made over the hematoma, and the skull explored. No evidence of fracture could be found. It was determined to open the skull for the purpose of exploration and decompression. Accordingly, the temporal muscle on the left side was exposed along its origin, its fascia turned back by a semilunar incision, and the fibres separated vertically, according to the method advocated by Cushing. A one-inch trephine opening was then made at a point one and one-half inches above, and one inch in front of the external auditory meatus, exposing the dura. This was seen to be dark in color, very tense and without pulsation. No extra dural hemorrhage was found. The skull was rongeuired away in all directions, making an opening of about  $2\frac{1}{2}$  inches in a longitudinal by 2 inches in a vertical diameter. The same condition of the dura was present in the whole area. A small opening was then made in the dura, and the blood-tinged cerebrospinal fluid spurted out to a distance of about 3 or 4 inches, thus showing the pressure under which it existed. The dura was then cut away over the whole surface from which the bone had been removed, exposing the brain beneath. The brain did not pulsate. The small superficial blood vessels were dilated to three or four times their natural size, and the blood in them was of a dark, venous color.

There was no actual trauma of either the vessels or the brain tissue itself apparent.

In the course of three or four minutes the pulsation in the brain gradually returned; the blood vessels became much less prominent, and the blood in them became of an arterial color. Coincident with these changes, the condition of the patient's pulse and respiration was closely watched, but it could not be determined that any change took place, the pulse rate remaining from 110 to 120. The temporal muscle, which had been retracted antero-posteriorly during the manipulations in the skull and brain, was now allowed to fall together again and was tacked with three or four catgut sutures. The temporal fascia and skin were carefully sutured along the curved section with catgut, a small drain being left down to the brain tissue. A copious dry dressing was applied to the wound. The child recovered from his anesthesia without incident, and in the course of three or four hours was entirely conscious with practically no symptoms of cerebral irritation. He gave the details of his injury, and told his name and address. His convalescence was uneventful; the wound healed per primam, and the pulsation beneath the temporal covering of the brain has been present ever since. There is no tendency for any increase in the size of the cerebral protrusion, but on the other hand, a decrease. Immediately after the operation, and during the following days, it was as much as one-half to three-quarters of an inch above the skull level. It has gradually lessened, until now its maximum is only one-quarter of an inch, and palpation shows it to be less tense than it was two weeks ago. It would have been better to have made an osteoplastic flap, but no instrument for this was at hand, excepting the gouge and mallet, which, under the existing conditions, would have been exceedingly dangerous from the continued jarring necessitated. An attempt to leave the dura in situ and resuture it failed because of the great tension, and the subsequent gradual subsidence of this tension shows that a replacement of this dense membrane would have continued to an excessive intracranial compression, and defeated the very object of the operation. The uncovered brain is a "silent area" and it may be hoped that the pericranium will develop enough thickness and firmness to protect it.

The conditions which determined operation on this boy were, rapidly increasing coma and cerebral excitability, with the strong

belief by those observing him, that he was developing the very condition found, namely, cerebral œdema, due to changes in the blood vessels, which would inevitably prove fatal if not relieved. The absence of localizing symptoms left no other course than to produce a decompression of the brain, and thus combat the increasing compression due to loss of tone in the cerebral vessels.

Subsequent note, Feb. 10th, 1908.—The protrusion of the brain has entirely subsided, and given place to a depression one-half inch below the scalp, that is, to its normal level. Except for the skull opening it is entirely normal. The satisfactory result here obtained by no means warrants the conclusion that such lesions invariably produce a picture so easily interpreted. It was the apparent hopelessness of not operating, that acted as the determining factor in deciding for operation.

Cannon and Cushing have studied this condition and both come to the conclusion that an œdema of the brain may arise in this way, through osmotic forces, sufficient to give pressure symptoms by driving out the blood from the medullary centres. In this particular case, this phase had just been reached, and it was apparently rapidly increasing.

CASE VII.—*Diffuse trauma of head. Symptoms of marked cerebral irritation and compression after three hours. More marked over right precentral area. No improvement for three days. Decompressing operation over right motor area. No localized lesion of any moment. Prompt improvement and ultimate recovery.*

A woman, age 28 years, fell from a street car on Aug. 24, 1907, striking her head on the pavement. She apparently received no severe injury and walked home. When seen by the ambulance surgeon shortly after, she was quite rational and apparently not much hurt. She refused to go to the hospital. Three hours later the ambulance was again called, and she was brought to the hospital, where examination showed the following condition: Patient lies on right side with knees drawn up. Arms folded across the chest. There is an apparent condition of chilliness, and the bed clothes are drawn up beneath the chin. She assumes above attitude whenever moved. Eyes are closed, breathing natural and she appears in natural sleep unless disturbed. She resents any interference, resisting more or less violently. She moves all extremities freely. Left arm decidedly weaker than right, also left leg

weaker than right. Irritation about the head makes apparent a paralysis of lower left facial branches. Pulse 56, hypertension. Left knee-jerk increased. No ankle clonus. Superficial reflexes unsatisfactory. Left pupil reacts to light normally. Right also. Pupils equal, and normal in size. Left eye fixed in external strabismus. Right eye moves on irritation. Palpation of skull shows profuse hematoma all over calvarium, but more on right than left side. For the following three days there was no marked change in any direction, though the slight left-sided paralysis seemed to be somewhat decreased. On Aug. 27th, operation was decided upon because of the signs of continued cerebral pressure as seen in the slow pulse, the irritable condition and the tendency to coma when left undisturbed.

*Operation.*—Skin incision over right Rolandic area after fissures had been mapped out on the skull. No fractures present. Trephine opening made and enlarged with ronguers. Brain showed increased intracranial pressure, but pulsated slightly. Opening of dura showed slight trace of dark colored blood clot. Reaction with a battery showed that left face area was exposed. Dura sutured with catgut. Rubber tissue drain. Skin flap sutured with interrupted silk sutures. Dressing applied. Patient returned to bed in fair condition with head elevated.

Post-operative notes, Aug. 28th.—The general condition is about the same, but the pulse has risen to 70 and 80, whereas before it ranged from 50 to 60 as the highest. Aug. 28th.—The general condition shows improvement, the irritability having almost disappeared. The subsequent course was toward uneventful recovery and by the end of the week the patient was in a normal condition, and the wound was entirely healed. Undoubtedly this case would have recovered without operation. The recovery would have, however, been slower, and there was present a very good chance of later manifestations, the "cerebrasthenia" of Bailey, developing.

A decompressing operation as practised in these two instances therefore seems justifiable in the border-line cases, where no localizing diagnosis can be made. As already pointed out, the same group of symptoms may arise from such divergent causes, and the pathological conditions present be so complex, including all the grades above enumerated under

class four, that their relief is problematical. The abdominal surgeon is often confronted with the impossibility of making a diagnosis in obscure lesions, but he has the advantage of being able to deal with whatever may be found on direct inspection of the organs. The brain surgeon cannot do this, and therefore an accurate diagnosis before operation is imperatively demanded despite the difficulties. The deductions to be drawn from these considerations are apparent. Every available point must be weighed in making a diagnosis and a prognosis.

The diagnostic data may be grouped as follows: First—those of the functional disturbance of the brain as a whole. Second—those of the actual damage of brain tissue over local areas. Third—those of the derangement of function due to lesions outside of the brain. Fourth—manifestations of injury shown in organs other than the sensorimotor system. The confusing symptoms falling under the first group are usually present to a greater or less degree, that is, concussion masks and distorts other symptomatic findings. The pupils, for example, may be equally dilated, or one may be inactive while the other may be normal. Statistics should theoretically throw some light on the location of a lesion producing such changes, but a study of the various authorities, and one's own experience, give such divergent results, that little value can be placed on them. Hutchinson has pointed out that the rule is to find the pupil on the injured side dilated, due to a paralysis of the third nerve or its connections. This is more applicable to basal hemorrhage with fracture of the base, however, or with a low hemorrhage from the middle meningeal artery. The explanation of the many exceptions is probably found in the complicating disturbance of function as a whole. The other reflexes are also of uncertain value, and for the same reason. The study of the second group, namely, diagnostic data derived from damage to brain tissue over a localized area, holds out more promise. But even here, casual observation is very deceptive, and only a most rigid analysis of each symptom can lead to any safe conclusion.

Cases II to V illustrate the difficulties encountered here. Sensori motor paralyses are practically the only guides of importance, because the interpretation of pure sensation by patients suffering from head injury is often unobtainable at all, and is always confused. Valuable diagnostic information may be obtained by the presence of symptoms due to associated injuries outside the brain. Of these, the presence of a fracture of the skull is of especial significance, and if the fracture exists on the vertex the associated injury is often easily determined by inspection at this point. On the other hand, fracture at the base of the skull gives no pathognomonic signs other than those of the fracture itself. The bleeding from the nose and ears or the escape of cerebral fluid, and the subconjunctival ecchymosis, are of no value in determining the damage to the nervous structures. Occasionally the paralysis of a cranial nerve at its exit from the skull is present, and thus the line of fracture may be determined but without additional information along the lines under consideration. Anatomical considerations may lead to the satisfactory localization of a compressing hemorrhage in such cases, and Cushing earnestly advocates a low exploration in these cases for the purpose, first, of removing what clot can be reached, and second, to give relief to compression by opening the skull. This procedure seems founded on sound principles of brain surgery, and certainly is worthy of wider application than it has had in the past. Under the fourth diagnostic grouping, that is, findings outside of the brain, there are four of value: First—that resulting from a tapping of the spinal cord. Second—a protrusion of the eyeballs. Third—the condition of the choked disc due to increased intracranial pressure. Fourth—the changes in the circulation and respiration due to interference with their medullary centres. The presence of blood in the spinal fluid is often the only diagnostic proof that the brain, or at least the dura, has suffered gross damage. This blood can have two sources, one from ventricular hemorrhage, and the other from subdural hemorrhage. Hemorrhage within the brain tissue does not give it. Fracture of the base usually does.

From this sign we may correctly infer a lesion other than severe concussion when this question is in doubt. The protrusion of the eyeball also shows increased intracranial pressure and is absent in concussion alone. The same is true of the choked disc, which is more marked on the side of greater pressure. This sign is of the utmost importance and often turns the scale in making the diagnosis of a compression being present. Cushing has shown that it is a very delicate sign and changes rapidly with the change in pressure.

The changes in the circulation and the respiration are equally important. Every operating room where brain surgery is done should be equipped with the means of accurate determination of these functions. The rate and force of the pulse are most important guides. A slow rate with marked variations during short intervals is significant of various stimulation with a tending toward paralysis of that centre. Many observers have found the change in blood pressure to be in direct relation to the change in intracranial pressure, but Cushing was the first in this country to emphasize that the rise in the former was a conservative act to keep up the circulation through the compressed centres. He reports a case where the blood pressure rose above 300 mm. of mercury, with a prompt fall when the intracranial pressure was released.

Eyster has worked out the changes in respiration. He showed that the arhythmic respiration is due to an alternate anæmia and vascularization of the centre with the failure or success of the blood pressure to keep up with the intracranial pressure. He also showed that the irritability of the respiratory centre is lost from anæmia sooner than the other centres. A rising blood pressure, with arhythmic respirations, therefore betokens the last stage of compression as given by Kocher. Hence, a close watch on these functions is most important for diagnosis and prognosis.

From the above outline of the complicated conditions found in brain trauma, one must conclude that it is among the most difficult pathological conditions the surgeon is called on to treat. But few words are needed to consider the opera-

tive procedure to be followed, once operation has been decided upon. Practically all parts of the skull, except the base and the lower occipital region, may now be opened by means of the osteoplastic flap. It is outside the scope of the present paper to discuss the technique and the details of this method in its manifold applications. It may, however, be said that the use of the trephine and the rongeur has largely been discarded for one form or another of the electrically run burr and saw, and that with the latter, very large areas of the brain may be exposed with the minimum of shock and damage to the skull. We may even indulge in the hope that the future will see still further improvements in these implements, to such an extent that the exploratory surgery of the brain may be more rational and less hap-hazard than it has been in the past. It is safe to say, that along these lines lies the development of a technique which will yield results far more favorable than any heretofore seen.

The seven cases here reported have been selected as illustrations of groups three and four of the original classification, adapted for the therapeutical consideration of intracranial lesions. Case I is a typical example of the definitely localized lesion, giving almost unmistakable symptoms. Case II shows a similar lesion, but with somewhat modified symptoms. Cases III, IV and V illustrate the sources of error where the clinical picture simulates a definitely localized lesion, but where no such lesion exists. Cases VI and VII were selected as examples of the fourth group or the border-line cases. In neither could a localized lesion be diagnosed, nor was one found at operation. Yet the general picture seemed to justify something being done to relieve cerebral irritation and pressure. The decompressing operation fulfilled these indications, and proved of value in both cases.

A critical analysis of the subject as illustrated in the seven cases warrants the following conclusions: First—In but rare cases, namely, those of isolated injury affecting the sensorimotor area, can a positive focal diagnosis be made. Second—All grades of brain injury may be found in different

parts of the same brain. Third—A general concussion may be followed by secondary changes in the circulation which, if not relieved, produce pressure and death. Fourth—A pure decompressing operation is indicated in two conditions: (*a*) for the relief of pressure due to inaccessible hemorrhage, and (*b*) to relieve the pressure arising from traumatic œdema of the brain. Fifth—Operation done without a very definite object in view, which object is based on careful diagnosis, is apt to be more harmful than helpful. Sixth—the whole subject is fraught with manifold difficulties and the brain surgeon should strive to become a practical neurologist in organic lesions.

## **SPLENECTOMY.**

REPORT OF SIX CASES, TOGETHER WITH A STATISTICAL SUMMARY OF ALL THE REPORTED OPERATIONS UP TO THE YEAR 1908.\*

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SPLENECTOMY, or the operation of removal of the spleen, may be indicated either because of pathological changes or injuries and wounds affecting that organ.

The physiology of the spleen presents many difficult problems for solution, but the classic experiments of Bardeleben, in 1841, showed that the spleen might be removed in healthy animals and be followed by no serious loss to the animal economy. The knowledge of this fact soon led to the performance of this operation in the case of human beings who presented evidence of disease or injury of the spleen.

The close relationship existing between the spleen and the blood-forming organs would lead one to suppose that its extirpation would be followed by pronounced alterations in the blood and lymphatic glands. It has been found that slight changes do occur but of an apparently insignificant character. Vulpius, who first made this feature the subject of experimental study, concludes as follows:

1. Extirpation of the spleen produces a transitory decrease in the number of red, and an increase in the number of white, corpuscles.
2. The thyroid gland cannot vicariously assume the function of the spleen.
3. The lymphatic glands and the bone marrow show an increased blood-forming activity after removal of the spleen.
4. The regeneration of the blood, after loss of blood, is

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probably less rapid in individuals in whom splenectomy has been performed.

It has been observed that some patients complain of pain in the bones after operation which has been attributed to increased medullary activity. In some few cases the thyroid gland has apparently hypertrophied, associated with symptoms of increased thyroid function. It has been suggested,—and experimental work to some extent corroborates this,—that an animal deprived of its spleen becomes more liable to infection by any pyogenic bacteria.

Extirpation of the spleen in human beings has been done for various conditions by a number of operators and we may conclude that splenectomy is a justifiable operation in certain cases. The operation, however, is a serious one and is attended with a high mortality. The chief inherent dangers are hemorrhage and shock, but there are many additional factors which have to be considered, such as the size of the tumor, the presence of adhesions, and other concomitant conditions. A correct knowledge of the disease process is most essential, and this has to do particularly with the question whether the lesion in the spleen is a primary affection, or a part of a more generalized process.

In order to speak with some degree of understanding on these points I have summarized the contents of an exhaustive monograph by Bessel-Hagen, in which all the recorded cases of splenectomy prior to 1900 are tabulated, and to these I have added an analysis of all the subsequent operations to the first of January, 1908. In this way I have collected in all 708 cases of splenectomy, including six cases of my own. The mortality in the whole series is 27.4 per cent., while that of the 8 years from 1900 to 1907, inclusive, is 18.5 per cent. The exact value to be placed on a statistical inquiry of the kind I have undertaken is difficult to estimate. The most noticeable thing is that a very large proportion of these 708 cases are reports of single cases by different operators. This fact has a bearing in two directions: in the first place it may be supposed that only successful cases are reported, while on

the other hand one's skill in performing an operation is largely dependent upon one's experience with it. With these appreciations of the possible fallacy in the deductions I will proceed to discuss the different lesions of the spleen that may, or may not, be treated by splenectomy, and the results of the operation up to the present time.

Bessel-Hagen,<sup>26</sup> in 1900, compiled 360 cases of splenectomy, exclusive of cases of partial splenectomy. Of these, 222 cases recovered and 138 were fatal, a mortality of 38.3 per cent. In his tabulation, however, he includes only 335 cases with 212 recoveries and 123 deaths, as he chose to omit certain cases in which he believes the value of splenectomy was biased by co-existing conditions. In the accompanying table I have attempted to include all the recorded operations of splenectomy up to January 1, 1908, but have been able to find only 353 cases reported prior to 1900.

*Idiopathic Hypertrophy of the Spleen.*—Chronic tumor of the spleen, in certain instances, may be justly attributed to one of several causes, to be found either in a primary condition of the spleen, or as a part of a constitutional dyscrasia. Quite apart from these factors, however, not a few cases of chronic splenic enlargement exist in which the clinical history and all the concomitant conditions throw absolutely no light on the origin of the tumor. Nor are the pathologists prepared to classify these enlarged spleens except under the general term of chronic indurative splenitis. It seems most probable, however, that the inception of the process is to be sought in some past infectious disease. Not a few cases are undoubtedly due to a latent malarial infection, as splenomegaly is very common in individuals who reside in or emigrate to malarial regions, who give no history of chills and fever. Other possible causes are to be sought in chronic infectious diseases, such as congenital and acquired syphilis, rickets, scrofulosis, scurvy, etc., and as a sequel to acute hyperplastic splenitis from various causes. Is it not possible that some general infections may occur in which the spleen may bear the brunt of the attack without other general manifestations? One well recognized

## SPLENECTOMY. STATISTICAL SUMMARY.

Disease or Lesion.	Bessel-Hagen to 1900.			Johnston, 1900-1908.			Total to 1908.		
	Cases.	Re-covered.	Died.	Cases.	Re-covered.	Died.	Cases.	Re-covered.	Died.
Idiopathic hypertrophy .....	33	20	13	41	33	8	74	53	21
Idiopathic hypertrophy, ectopic spleen.....	45	40	5	15	14	1	60	54	6
Idiopathic hypertrophy, twisted pedicle .....	16	8	8	11	11	0	27	19	8
Malarial hypertrophy .....	88	58	30	61	53	8	149	111	38
Malarial hypertrophy, ectopic spleen.....	26	25	1	14	14	0	40	39	1
Malarial hypertrophy, twisted pedicle.....	5	3	2	7	7	0	12	10	2
Splenic anaemia .....	17	12	5	44	37	7	61	49	12
Cysts, hydatid.....	15	11	4	8	8	0	23	19	4
Cysts, non-parasitic.....	7	7	0	12	12	0	19	19	0
Leukemia .....	42	4	38	7	2	5	49	6	43
Tuberculosis of spleen.....	4	3	1	6	5	1	10	8	2
Sarcoma of spleen .....	9	6	3	3	3	0	12	9	3
Abscess of spleen .....	7	7	0	2	1	1	9	8	1
Miscellaneous affections .....	2	1	1	11	10	1	13	11	2
Wounds and injuries.....	37	20	17	113	79	34	150	99	51
Totals .....	353	225	128	355	289	66	708	514	194
Per cent.....	63.7	36.3		81.5	18.5		72.6	27.4	

cause is found in all conditions of congestion or stasis, such as an obliterative phlebitis of the splenic vein, and particularly chronic occlusion of the portal vein with associated cirrhosis of the liver.

The indications for the removal of the idiopathically enlarged spleen are not at all absolute. It is principally justified as a prophylactic measure, as an otherwise trivial traumatism may seriously jeopardize the patient's life by the susceptibility of the enlarged spleen to rupture. The mortality depends directly upon two factors: the size of the spleen, and the skill and experience of the operator.

Prior to 1890 splenectomy was performed for idiopathic hypertrophy 18 times with 7 recoveries and 11 deaths; from 1890 to 1900, 15 cases were treated by splenectomy with 13 recoveries and 2 deaths; from 1900 to 1908 I have collected 41 splenectomies with 33 recoveries and 8 deaths (see bibliography). This gives a total of 74 splenectomies with a mortality of 28.3 per cent.

*Ectopic Spleen with Idiopathic Hypertrophy.*—By far the most common cause of displaced, or wandering, spleen is an enlargement of that organ which induces a relaxation of its suspensory apparatus. In rare instances an ectopic spleen may be a congenital anomaly, as in a case cited by Moynihan in which a boy twelve years old had a spleen so mobile that it would lie in the left iliac fossa. The only other condition in which a spleen of normal size is found displaced is in connection with a general visceroptosis, as in Glenard's disease.

The indications for splenectomy in cases of ectopic hypertrophied spleen are usually definite. A patient with a large floating spleen is always in jeopardy from the possible occurrence of torsion of the pedicle. In not a few cases distinct subjective symptoms are found to be due to a displaced spleen, as it may exert pressure on, or become attached to, various organs in the abdominal cavity. A rather frequent situation is in the pelvis, where it may become adherent to the uterus, as in one of my cases, so as to simulate a subserous fibroid.

In some cases intestinal obstruction has been caused by the pressure of a wandering spleen.

The statistics of splenectomy for ectopic hypertrophied spleen show 17 operations prior to 1890 with 14 recoveries and 3 deaths; from 1890 to 1900, 28 splenectomies were done with 26 recoveries and 2 deaths. Since 1900 I have been able to find reports of only 14 cases with 13 recoveries and 1 death, as follows: Bland-Sutton<sup>27</sup>; Bryson<sup>30</sup>; Haeckel<sup>96</sup>; Lucy<sup>149</sup>; Schon<sup>217</sup>; K. Schwarz<sup>218</sup>; Silvestri<sup>223</sup>; Ashby,<sup>9</sup> large ectopic spleen complicated by typhoid fever; Llobet,<sup>147</sup> displaced hypertrophic spleen with primary carcinoma of pedicle; Tridondani,<sup>247</sup> very large ectopic spleen in a pregnant woman, delivery followed by splenectomy; Power,<sup>191</sup> large ectopic spleen due to a blow received 3½ years prior to operation; and three instances of pelvic displacement of spleen for which splenectomy was done by Cestan,<sup>49</sup> Peterson,<sup>184</sup> and Sokoloff.<sup>228</sup> To these I add one successful case of my own, in which the moderately enlarged spleen was firmly adherent to the fundus of the uterus. We thus have in all a record of 60 splenectomies for idiopathically enlarged wandering spleen, with 54 recoveries and 6 deaths, a mortality of 10 per cent.

*Ectopic Hypertrophied Spleen with Twisted Pedicle.*—As has already been said torsion of the pedicle is an accident that may occur in any case of wandering spleen. This may take place slowly so as to cause a gradual enlargement of the organ. In other cases the twist occurs suddenly and gives rise to most acute symptoms similar to those caused by the twisting of the pedicle of an ovarian cyst. It is usually possible in these cases to make out the tense and tender spleen, but in other instances operation has been performed for supposed intestinal perforation or strangulation.

Splenectomy is an operation of necessity in this condition, and the results of the cases that I have been able to find since 1900 are surprisingly good,—11 cases without a death. Prior to 1890 splenectomy for wandering spleen with twisted pedicle was done 5 times with only 1 recovery and 4 deaths, and from

1890 to 1900, 11 times with 7 recoveries and 4 deaths. The 11 additional cases which I have collected include one case each by Chandelux<sup>52</sup>; Cocran<sup>54</sup>; Hunter<sup>111</sup>; Steinbrueck<sup>233</sup>; Ullmann<sup>250</sup>; one case by Childe<sup>53</sup> complicated by a large sub-capsular hemorrhage; one case by Wallace<sup>254</sup> in a girl 12 years old; two cases in which the spleen lay on the right side of the uterus by Edge,<sup>72</sup> and by Webster<sup>260</sup> and one case by Vincent and Cabanes,<sup>253</sup> in which the spleen lay in the right iliac fossa.

*Malarial Hypertrophy of the Spleen.*—Malarial fever is a well-recognized cause of chronic splenic tumor. The "ague cake" occurs in individuals who are either repeatedly exposed to infection, or in those who are insufficiently treated. Such patients develop a more or less pronounced cachexia and for this reason splenectomy has been repeatedly performed in the mistaken idea (Jonnesco) that the spleen continues to be a habitat for the malarial parasites.

The chief indications which call for the removal of the malarial spleen are its increased size, increased mobility, its consequent tendency to rupture, and the danger of acute torsion of the pedicle. Spontaneous rupture is not infrequent in the Tropics, as the organ is easily lacerated by minor grades of traumatism that would not seriously affect a healthy spleen. The chief factors in producing mortality appear to be the large size of the tumor, and the presence of marked anæmia and cachexia.

In the period before 1890 splenectomy for enlarged malarial spleen was done 24 times with 9 recoveries and 15 deaths; and during the period 1890 to 1900, 64 times with 49 recoveries and 15 deaths. Since 1900 I have been able to collect 58 splenectomies by 31 operators, with 50 recoveries and 8 deaths (see bibliography), to which I add 3 successful cases of my own making 61 splenectomies with 53 recoveries and 8 deaths, a mortality of 13.1 per cent.

*Ectopic Malarial Spleen.*—The same indications for operation apply here as in the case of the idiopathically enlarged wandering spleen. Reports of the cases of splenectomy

in this condition would seem to indicate that the operation is performed at a more favorable period in the patient's illness as the mortality is exceedingly low. Prior to 1890, 11 cases are reported with no deaths, and from 1890 to 1900, 15 cases with 14 recoveries and 1 death. Since 1900 I have collected 14 additional cases without a death. Of these, 8 are reported by R. Schwarz,<sup>219</sup> and one each by Bargellini,<sup>16</sup> Carini,<sup>42</sup> Kelley,<sup>128</sup> Nuñez,<sup>174</sup> Potherat,<sup>190</sup> and Sakharov.<sup>212</sup>

*Ectopic Malarial Spleen with Twisted Pedicle.*—As has already been said in speaking of idiopathically enlarged spleens, torsion of the pedicle is an absolute indication for operation and removal of the spleen. Prior to 1890 this was done in two cases with 1 recovery and 1 death, and from 1890 to 1900, 3 times with 2 recoveries and 1 death. Since 1900 I have collected 7 cases without a death; 2 cases reported by R. Schwarz,<sup>219</sup> and one each by Bennett,<sup>21</sup> Coen,<sup>55</sup> Montanari,<sup>165</sup> Pozzi,<sup>194</sup> and Vignard.<sup>252</sup>

*Splenic Anæmia—Banti's Disease.*—Under the term splenic anæmia are grouped certain cases of splenic enlargement associated with anæmia. There is no history of malarial fever and the subsequent course of the disease differs from that of chronic malaria with enlarged spleen. Banti, in 1894, called attention to the frequent development of cirrhosis of the liver as the disease progresses, and the term Banti's disease is really applicable to those cases only which show the characteristic signs as he described them, viz., anæmia, splenomegaly, and hepatic cirrhosis with ascites. In splenic anæmia there is no general glandular enlargement, which serves to distinguish it from Hodgkin's disease with splenic involvement. It is differentiated at once from leukæmia by the blood picture. The usual findings in splenic anæmia are a diminution in the red cells to an average of 2,500,000 to 3,000,000 per c.mm. with a relatively greater decrease in the proportion of hæmoglobin, so as to produce the picture of a very severe chlorotic anæmia. The leucocyte count is characteristically low, usually ranging from 2000 to 3000 per c.mm. The leucocytic formula departs but slightly from the normal, although there

may be a slight increase in the relative proportion of the mononuclear elements. Abnormal blood cells,—myelocytes, nucleated red cells, etc.,—do not appear in the circulating blood.

The etiology of Banti's disease is absolutely unknown, and much careful study has failed to show whether the anæmia is secondary to some condition in the spleen or whether both the anæmia and splenic enlargement are dependent on some primary condition. As the usual course of the disease is gradually downward it has been hoped that the patient may be cured by removing the spleen. In two carefully studied cases operated upon by Harvey Cushing and J. C. Warren in 1898 and 1900 the patients are reported well and strong after 8 years and 6½ years respectively.

Prior to 1900 there are reports of 17 splenectomies in splenic anæmia with 12 recoveries and 5 deaths. These cases are cited in a paper by Torrance<sup>245</sup> who records one successful case of his own in 1907 and collects 18 other cases in which splenectomy was done between 1900 and 1907 with 14 recoveries and 4 deaths. These 18 cases were reported or operated upon by Harris and Herzog, Warren, Jaffe, Tscherniachowski, Cushing, Mayo (2 cases), Halsted, Bevan, Gordon, Jonas, Clarke, Laspeyres, Hart, Koenig, Harris, Armstrong, and Carr. I have been able to find 25 additional cases, reported since 1900 and not mentioned in Torrance's article, with 22 recoveries and 3 deaths, viz.: Bérard<sup>22</sup>; Bucco<sup>40</sup>; Caro<sup>45</sup>; Carstens<sup>47</sup>; Davis<sup>62</sup>; del Castillo Ruiz<sup>48</sup>; Flammer<sup>79</sup>; Gangitano<sup>86</sup>; Latarget<sup>137</sup>; Legnani<sup>141</sup>; Levison<sup>143</sup>; Martinelli<sup>152</sup>; Polosson and Violet<sup>188</sup>; Quénu and Duval<sup>195</sup>; Rieppi, 2 cases<sup>204</sup>; Roger, 2 cases<sup>207</sup>; Stirling, 2 cases<sup>234</sup>; Tansini, 2 cases<sup>238, 239, 240</sup>; Thiel<sup>241</sup>; Thienhaus<sup>242</sup>; and Umber.<sup>249</sup> In 4 of these cases, those of Bucco, Gangitano, and the two of Tansini, the patients were in the so-called third stage of Banti's disease, and Talma's operation was done in the attempt to control the ascites. Three of these cases recovered and 1 died.

We thus have in all, up to the present writing, reports of

61 cases of splenic anæmia, or Banti's disease, treated by splenectomy with 49 recoveries and 12 deaths, a mortality of 19.5 per cent.

*Cysts of the Spleen.*—Three kinds of cysts have been found in the spleen: (1) non-parasitic cysts (serous cysts, blood cysts, and lymph cysts); (2) hydatid cysts; and (3) dermoid cysts.

There is only one reported instance of dermoid cyst of the spleen. This was reported by Andral in 1829, and was said to contain fatty matter like tallow, with hairs scattered throughout.

Hydatid cysts are the most common form of cysts of the spleen, but are only found in those countries in which hydatid disease occurs. These cysts may attain large size and are most commonly treated by incision and drainage. In other instances splenectomy has been done. Prior to 1890 there are records of 5 splenectomies with 2 recoveries and 3 deaths; from 1890 to 1900, 10 splenectomies with 9 recoveries and 1 death. Since 1900 I have found reports of 8 splenectomies with no deaths, viz., Carnabel<sup>44</sup>; Delore<sup>63</sup>; von Herczel<sup>105</sup>; Jordan<sup>125</sup>; Latarget<sup>137</sup>; Slavchev<sup>227</sup>; Tricomi<sup>246</sup>; and Giannettasio.<sup>90</sup>

Non-parasitic cysts may be unilocular or multilocular. The most common kind is the blood cyst, which results from hemorrhage either into the substance of the spleen or just beneath the capsule. A history of trauma is obtained in many cases, while in other instances the cyst probably results from a partial rupture of the spleen during the course of some acute infection, such as typhoid fever. In not a few of the recorded cases the cyst has been found in distinctly hypertrophied spleens, which, as has already been mentioned, are especially liable to injury. It is questionable whether some of these cases should really be classified as blood cysts because the condition, as described, appears to be simply a subcapsular hæmatoma. Blood cysts of long standing usually show a distinct thick capsule, and are found to contain shreds of fibrin and granular detritus.

Serous cysts are in all probability hemorrhagic in origin, and, as Moynihan says, the solid constituents of the blood are no doubt deposited laminally upon the wall of the cyst, the fluid contents becoming thereby clearer. The operative procedure in cases of serous cysts will depend on conditions as found upon opening the abdomen. Simple puncture and the withdrawal of the fluid is not only obsolete but dangerous. If the cyst is of such size that most of the spleen tissue is destroyed, splenectomy is the operation of choice, provided there are not too many dense adhesions about the organ. If, as in some reported cases, *e.g.*, Powers' case,<sup>192</sup> splenectomy would be either impossible or extremely hazardous, then it becomes necessary to drain the cyst, after suturing it to the abdominal wall. Occasionally the cyst can be enucleated, as in a recent case of mine, in which a cyst the size of a goose egg was shelled out from the under surface of the spleen and the raw surface of the spleen closed by two sutures threaded on blunt liver needles.

Prior to 1890 splenectomy was done 4 times for non-parasitic cysts without a death; from 1890 to 1900, 3 times with no mortality. Powers<sup>192</sup> writing in 1906, has collected six cases of non-parasitic cysts reported since 1900 in which splenectomy was performed with no deaths, *viz.*, cases by Michailowsky, Routier, Dalinger, Jordan, Monnier, and Heinrichus. In addition to these I have collected 6 more cases of splenectomy for this condition, in all of which recovery ensued, *viz.*, Bacelli<sup>18</sup>; Bryan<sup>38</sup>; Gerard<sup>89</sup>; Israel<sup>112</sup>; Leonte<sup>142</sup>; and McMurtry.<sup>158</sup> This gives a total of 19 splenectomies for non-parasitic cysts of the spleen with 19 recoveries and no deaths.

*Leukæmia.*—The removal of the spleen in splenomyelogenous leukæmia is very definitely contraindicated. In the early period of splenic surgery, splenectomy was repeatedly performed in the hope of eradicating the disease. In 1894, Vulpinus and Ceci collected 28 cases of splenectomy in leukæmia with 25 deaths immediately after the operation. Of the 3 cases that survived the operation one lived 13 days, another

8 months, while the third is reported as having been cured (Franzolini's case).

The total number of cases of leukæmia that were treated by splenectomy up to 1900 number 42. Of these, 4 are reported to have recovered and 38 died. Since 1900 I have found 6 additional cases, viz., Blanquinque<sup>28</sup>; Cetnarowski<sup>50</sup>; Lindner<sup>146</sup>; McGraw<sup>156</sup>; Piquand<sup>185</sup>; and Warren.<sup>257</sup> Four of these cases died very promptly after operation, while 2 cases—those of Lindner and Warren—survived. Warren's case lived about four years while the late result in Lindner's case is not known. To these I add one case of my own, in which the patient died 5 days after operation. A post-mortem examination was not obtained, and I was not able to determine the exact cause of the fatal termination as there were no evidences of either hemorrhage or peritonitis. This makes a total of 49 splenectomies in myelogenous leukæmia with 6 recoveries and 43 deaths, a mortality of 87.7 per cent.

From these results it is obvious that splenectomy is unjustifiable in leukæmia. Hemorrhage and shock are the chief factors in the mortality of this operation. In addition, our present conception of the bone marrow changes in this disease would seem to demonstrate the futility of splenectomy to stay the progress of the malady.

*Tuberculosis of the Spleen.*—Tuberculosis of the spleen does not occur as a primary affection, but nevertheless several interesting cases are on record in which a tuberculous spleen has been removed with subsequent entire recovery. These cases all presented splenic tumors and in one of them, at least, the diagnosis of tuberculous spleen was entertained because of coincident signs in the lungs. It may be said, however, that it is impossible to make a diagnosis of tuberculosis of the spleen and the condition can therefore never be treated as such.

Prior to 1890 there is a report of only 1 case of splenectomy for tuberculosis, and this resulted fatally (Burke's case). From 1890 to 1900 there are reports of 3 cases by Bland-Sutton, Lannelongue and Vitrac, and Marriott. These 3 cases all recovered, and Marriott's case, operated upon in 1891, was reported alive and well in 1906 (Moynihan). Since 1900,

I have found 6 cases of splenectomy for tuberculosis of the spleen, with 5 recoveries and 1 death. These cases were reported by Bayer,<sup>19</sup> Carle,<sup>43</sup> Cominotti,<sup>58</sup> Delore,<sup>64</sup> Franke,<sup>82</sup> and Grillo.<sup>93</sup> The case of Quénu and Baudet (1898) was not a typical splenectomy, as only a part of the spleen was removed and the lower pole drawn into the peritoneal wound and drained; suppuration continued for 4 months, and tubercle bacilli were found in the discharge. Bayer's paper has record of 9 of these cases, including that of Quénu and Baudet. Franke's case recovered from the operation but died 26 days later after leaving the hospital against his orders.

*Sarcoma of the Spleen.*—An excellent résumé of the subject of sarcoma of the spleen is to be found in the paper by Jepson and Albert<sup>116</sup> in which are collected all the cases up to and through 1904, including their own case in which splenectomy was done. Since that time I have found only one instance of splenectomy for sarcoma of the spleen, and that is the case reported by Willy Meyer in February, 1906.<sup>161</sup> This was a round-celled sarcoma and apparently not primary, as there were evidences of further metastases in the abdomen. This patient recovered from the operation and was in fair health 2 months later.

Eleven cases of splenectomy for sarcoma of the spleen are collected by Jepson and Albert. Of these 8 recovered and 3 died. One patient (Fritch-Ashe) lived 6½ years and then died of a cardiac affection. Jepson's patient was in good health 10 months after the operation. Three of the 8 cases are known to have died from recurrence of the growth.

Although the spleen seems to possess a relative immunity to secondary involvement by new growths, yet secondary sarcoma is undoubtedly more common than a primary growth. It is quite possible, however, that a sarcoma may originate in either the capsule and trabeculæ, lymphoid tissue, or endothelial cells, giving rise respectively to fibrosarcoma, lymphosarcoma, and endothelial sarcoma (Jepson). Except for the firm, solid, and usually irregular tumor, there is nothing characteristic in the symptoms, or in the blood picture, of sarcoma of the spleen.

Carcinoma of the spleen has never been recorded in any case which will bear investigation (Moynihan).

*Abscess of the Spleen.*—Abscess of the spleen is a distinctly rare condition, and is always secondary to an infective lesion either in the course of the blood stream or in immediate contiguity to the spleen. The most common cause is an infected embolus which gives rise to a septic infarct. This may occur in the course of an acute infectious disease, or follow some local suppurative lesion, especially in the portal area, such as appendicitis, pyosalpinx, etc.

Surgical treatment is always indicated in abscess of the spleen. Incision and drainage is the operation of choice, especially if the abscess is pointing, or dense adhesions are found about the spleen. In a few cases splenectomy has been done, 3 times prior to 1890, and 4 times between 1890 and 1900. All 7 of these cases recovered. Since 1900 I have found reports of 2 splenectomies for abscess with 1 recovery and 1 death, viz., Eberhart,<sup>71</sup> streptococcus infection, necrosis and abscess of spleen, recovery from operation, died 3 months later from pyæmia; and Karewski,<sup>127</sup> traumatic, necrosed spleen with subphrenic abscess, recovery.

*Miscellaneous Affections of the Spleen.*—Five splenectomies, with 4 recoveries and 1 death, have been performed since 1900 for "pseudoleukæmia." Two of these cases, DeRenzi<sup>67</sup> and Salvia,<sup>213</sup> were instances of infantile splenic pseudoleukæmia, with recoveries in each. Rochard's<sup>205</sup> case was probably one of splenic anæmia; Cetnarowski's<sup>50</sup> probably a malarial hypertrophy, while the exact nature of Erbkam's<sup>75</sup> case is not clear.

Wolff,<sup>264</sup> in 1906, reports the successful removal of the spleen in a case of infantile splenic anæmia.

Two splenectomies have been done since 1900 for benign growths, viz.: von Burckhardt<sup>41</sup> removed the spleen together with a growth involving the splenic ligament which proved to be a myxofibrolipoma; and Noguchi<sup>172</sup> extirpated the spleen together with a very large peritoneal lipoma. Both patients recovered.

Tietze<sup>243</sup> performed a successful splenectomy on a patient who had an echinococcus cyst of the spleen opened 3 years previously. The spleen was removed in order to cure a persistent sinus.

Winckler<sup>263</sup> reports a case of aneurism of the splenic artery in which he did a splenectomy. The patient recovered.

My sixth case of splenectomy may be tabulated in this group. The patient had been operated upon three years previously for an abscess of the spleen, the organ being fastened to the abdominal wall, incised and drained. She came to me with a good-sized ventral hernia in which was found a moderately large incarcerated spleen. The spleen, together with a large portion of adherent omentum, was removed, and the hernia repaired. In addition, complete hysterectomy was performed for carcinoma of the body of the uterus. The patient made a good recovery, and was reported to be in good health 2 years later.

Prior to 1900 there are records of 2 cases of benign growth of the spleen treated by splenectomy, with 1 recovery and 1 death.

#### WOUNDS AND INJURIES OF THE SPLEEN.

*Rupture of the Spleen.*—Subcutaneous rupture of the spleen is not a very rare accident. The normal spleen is only apt to be damaged by crushing injuries, but an enlarged spleen is readily torn by blows, not a few cases being due to kicks from a horse, and by falls. It is surprising how trivial an injury may cause a laceration of a hypertrophied spleen. Rupture of the spleen is particularly fatal because of the very extensive hemorrhage that almost always ensues. Immediate operation is imperative and it is usually found necessary to remove the spleen. Berger,<sup>24</sup> in 1902, collected 67 cases of ruptured spleen treated by splenectomy with 38 recoveries and 29 deaths.

*Penetrating Wounds.*—These are caused either by gunshot or stab wounds. The spleen is very rarely the only organ injured and the prognosis depends very largely upon the extent of the traumatism. The indications are for immediate opera-

tion, but the exact method to be followed in treating the wounded spleen can only be determined after the abdomen is opened. In some cases the splenic wound can be closed by suture, or the wound may be cauterized and tamponed. If the injury is multiple, or the rent large, splenectomy is the operation of choice. Berger's statistics (*loc. cit.*) give 6 cases of gun-shot wound treated by splenectomy with 2 recoveries and 4 deaths, and 7 cases of stab wounds in which the spleen was extirpated with 5 recoveries and 2 deaths.

Grouping together all traumatic lesions of the spleen there are reported up to 1900, 37 cases with 20 recoveries and 17 deaths. Since 1900 I have collected 113 cases (see bibliography) with 79 recoveries and 34 deaths. Of these 113 cases, 11 were gun-shot wounds with 8 recoveries and 3 deaths, viz.: Brennflech<sup>36</sup>; Carr<sup>46</sup>; Freund<sup>83</sup>; Graf,<sup>92</sup> 2 cases; Hartmann<sup>101</sup>; Hotchkiss<sup>109</sup>; Lebreton<sup>140</sup>; Longo<sup>148</sup>; Noetzel<sup>171</sup> and Penkert<sup>182</sup>; and six were stab wounds, viz.: Bernhard<sup>25</sup>; Ciechomski<sup>51</sup>; Demons<sup>65</sup>; Korn<sup>133</sup>; Krjenkow<sup>134</sup>; and Moses.<sup>166</sup>

We thus have reported in all, up to 1908, 150 cases of splenectomy for injuries and wounds of the spleen with 99 recoveries and 51 deaths, a mortality of 34 per cent.

#### SUMMARY.

As shown in the preceding table, there are herewith collected and tabulated 708 operations of splenectomy with 514 recoveries and 194 deaths, a mortality of 27.4 per cent.

In the period from 1900 to 1908 there are records of 355 splenectomies with 289 recoveries and 66 deaths, a mortality of 18.5 per cent. If the instances of removal of the spleen for traumatic affections of that organ be excluded there remain 242 splenectomies with 210 recoveries and 32 deaths, a mortality of 13.2 per cent. The well-recognized contraindication to operation in leukæmia may furthermore serve to exclude the seven cases in this series, which leaves a total of 235 splenectomies for diseases of the spleen with 208 recoveries and 27 deaths, a mortality of 11.5 per cent.

## SUBCUTANEOUS RUPTURE OF THE SPLEEN.\*

REPORT OF CASES WITH REMARKS.

BY GEORGE G. ROSS, M.D.,

OF PHILADELPHIA,

Assistant Surgeon German Hospital; Surgeon Germantown Hospital.

CASE I.—Robert S. Age 8. History of having fallen 8 feet down a cellar way, striking on left side of abdomen in left hypochondriac region. Accident November 3, 1907.

The first urination after the accident showed evidence of blood. He did not vomit; no marked evidence of shock; bowels moved normally. The next two succeeding days he was not so well and when I saw him two days later he presented the following symptoms:

Expression anxious, indicating some severe abdominal lesion. Some meteorism, but no vomiting. Temperature 102; pulse 20; respiration rapid and shallow. Lips and mucous membrane pale. Rigidity of left rectus muscle; tenderness most marked over splenic area. Complained of pain in left upper abdomen. The kidneys and bowels had acted normally and showed no evidence of blood. The degree of traumatism and its application to the splenic area, followed by the evidence above related, makes the diagnosis of contusion of the spleen, slow hemorrhage and a low grade, more or less localized, peritonitis, most reasonable. He also had a contusion of the left kidney as evidenced by the one hemorrhage. The boy had a slow but satisfactory recovery without operation.

CASE II.—Jacob H. Age 21. Painter. Was admitted to the German Hospital on the afternoon of September 28, 1907, having been referred by Dr. Klemm.

Patient's previous history of no importance or bearing on present condition.

Dr. Klemm kindly furnished the notes of the accident and the condition immediately following:

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\* Read before the Philadelphia Academy of Surgery, March 2, 1908.

"Jacob H. came to my office stating that two hours before he had fallen from bay window on a fence, striking on his upper abdomen. He soon recovered sufficiently to walk to his home, a distance of ten squares, then to my office another six squares and back to his home. He was pale, not able to stand fully erect; his pulse was 96; temperature normal; he referred his pain to the epigastrium, radiating toward the left side and the back. I advised him to go to the German Hospital for observation, to which his mother objected, then I ordered him to bed and to let me know if he got worse. The next day I found him, with abdomen distended, pulse 136, temperature 100, more pale and willing to go to the hospital at once."

On admission he was very pale, expression anxious. Temperature 100; pulse 148; respiration 26. Abdomen showed no ecchymosis, bruise, cut or evidence of traumatism. Lungs clear. Heart action rapid. No murmurs. Pulse rapid, weak and running. Abdomen moderately distended; general rigidity and marked tenderness. Complained of severe abdominal pain, most intense in the left hypochondrium. Hæmoglobin 48 per cent., leucocytes 20,000.

Operation on admission, 24 hours after the injury. Abdomen was opened through right rectus muscle with line of umbilicus as central point. A large amount of very dark unclotted blood escaped. A rapid survey of small and large intestine and their mesenteries, also of the liver, proved them to be intact. As the examination approached the spleen it was noticed that the blood was clotted and an examination discovered a rent in the spleen. The patient by this time was practically pulseless. Intravenous salt solution was started—a total of 2000 c.c. being given. Another incision through the abdominal wall over the spleen and three pieces of gauze were packed around the organ. A stab wound over the pubis was made for the insertion of a glass drainage-tube; the original wound was closed, excepting at the lower angle, where one piece of gauze was placed for drainage. The abdomen was not washed out. The patient made a slow recovery. On the twentieth day the temperature shot up to 104 and the pulse to 138 without a known cause, and stayed up until the thirty-fifth day, when it again reached normal. The leucocyte count at this time was 9700. Widal negative.

Subcutaneous injuries of the spleen vary from simple contusion to complete pulpification, the extent of the injury being governed by the amount and direction of the applied force and the condition of the organ. An abnormal spleen either enlarged or unduly friable will be more readily and more severely injured by minor degrees of traumatism. That the normal spleen is liable to severe injury is proven by the number of cases on record. At the height of its functional activity, the spleen is engorged with blood and is at this time more liable to injury. This condition occurs some hours after digestion. The two cases herewith reported illustrate rupture in two degrees of severity, in normal or presumably normal organs. Both were in males.

In Berger's collection, 300 cases were in men and 60 in women.

Subcutaneous injuries are more common than through open wounds. Edler's 160 cases show 51.8 per cent. as subcutaneous to 48 per cent. from gun shot and stab wounds.

Berger, *Archiv für Klin. Chirurgie*, 1902, vol. 68, pp. 768-817, gives a review of all cases up to 1902, from which the following facts have been deduced:

Frequency of rupture of the spleen compared with same injury to the other solid viscera due to traumatism he gives as follows: rupture of spleen, 20 per cent.; rupture of kidney, 22 per cent.; rupture of liver, 37.5 per cent.

Contusion of the spleen regarded as an authentic diagnosis, is in many cases hard to diagnose from rupture. The symptoms are pain and tenderness in region of the spleen, enlargement of the organ, fever, shock without evidence of hemorrhage.

*Age of Cases.*—Report of German cases: age from 0 to 10, 38 cases; 11 to 20, 33 cases; 21 to 30, 42 cases; 31 to 40, 32 cases; 41 to 50, 15 cases; 51 to 60, 15 cases; over 60, 9 cases. Report of English cases: age from 1 to 10, 11 cases; 11 to 20, 18 cases; 21 to 30, 15 cases; 31 to 40, 15 cases; 41 to 50, 6 cases; 51 to 60, 11 cases; over 60, 11 cases.

NOTE.—One case in a new-born infant, which was dropped on floor in precipitate labor.

*Pathology.*—Somewhat less than half of the ruptures affected a diseased spleen, in most cases malarial. It was especially common also during acute infections with splenic enlargement.

Of 132 pathological ruptured spleens: 93 were malarial, 15 only enlarged, no cause stated, 5 in typhoid, 1 in typhus, 1 in pneumonia, 3 in leukæmia, 1 in hereditary syphilis and alcoholism with liver cirrhosis, 9 in pregnancy, 1 in tuberculosis, 1 in other diseases.

*Spontaneous Rupture.*—Referred to by Berger. He gives over 30 examples, some with slight trauma, as bending or in labor. He reports one case in a man lying absolutely still.

*Prognosis of Ruptured Spleen.*—*Unoperated:* of 220 cases, 17 recovered—mortality, 92.3 per cent. *Operative results:* splenectomy, 67 cases, 38 recovered, 29 died—mortality, 56.7 per cent.; splenorrhaphy, 2 cases, 1 recovered, 1 died—mortality, 50 per cent.; tamponade, 6 cases, 5 recovered 1 died—mortality, 83.3 per cent.

In the above splenectomies 13 had complicating injuries, of which 9 died. In two of the recovered ones the complications were very slight.

#### LATER REPORTS OF RUPTURE OF SPLEEN.

1. BEAUMONT. Trans. Clin. Soc. London, 1902-3, xxvi, 261. Reports case of man hit by wagon tongue; spleen was ruptured. Operated. Splenectomy. Developed a left pleurisy and empyema. Had enlarged lymphatics one month after operation. No pathology of spleen.

2. FREUND. St. Louis Med. Cour., 1906, xxiv, 135-137. Reports one case of splenectomy for rupture with recovery. Operation within 24 hours. Noted leucocytosis of 9000 on admission, 18,000 on third day.

3. KIRCHNER. Ibid. Mentions 5 or 6 cases with 3 or 4 recoveries. No exact data.

4. BREWSTER. Boston M. and S. Journ., 1904, cl, 211. Reports a case of rupture of the spleen on a female of 6. Operated evening of the second day, with diagnosis of probable rupture of intestines. Wound in spleen packed, a drain was brought out by counter opening in flank.

5. SIMPSON. Lancet London, 1906, II, 364. Case of splenectomy for ruptured spleen. Operated in 5¼ hours.

6. NOETZEL. W. Beitr. z. klin. Chirurgie, 1906, xlviii, 309. Reports

five cases of splenectomy for rupture. Two recovered. One operated in 24 hours. One on third day. Of the three that died (no pathological report), 1 died apparently of shock, 1 of rupture of liver and heart complicating splenic condition, 1 of rupture of intestine (not found at operation). He calls attention to need of examination for associated lesions of viscera when doubtful.

7. FRANK. Munch. med. Wchnschr., 1906, liii, 189. Reports two cases of splenectomy for rupture. One operated within 24 hours and one on second day. The latter worked 2 days after accident—had subcapsular hemorrhage which broke second day and necessitated operation. Complicated by pneumonia and pleuritis. No pathological report.

8. FONTOYNONT. Bull. et Mem. Soc. de Chir. de Paris, 1905, us. xxxi. Reports a case of splenectomy for rupture in a woman of Madagascar, who had malaria and syphilis. Operated in 2 hours. Spleen removed as was also an injured portion of tail of pancreas. Clamps left on vessels. Spleen free of blood weighed 500 grams. It was hypertrophied and malarial.

9. SCHLUETHER. R. E. J. Missouri Med. Ass., 1905-6, 11, 23-26. Reports splenectomy in boy of 14, for rupture. Spleen entirely broken in half. Operated in 18 hours. Bleeding had spontaneously ceased. He notes hypertrophy of lymphatics in second week after operation.

10. ANORAY. Bull. et Mem. Soc. de Chir. de Paris, 1904, xxx, 900-911. Reports two cases of splenectomy for rupture, with recovery. He advises resection of ribs to expose the field of operation. He refers to several other cases and to 3 cases of spontaneous cure.

11. SHERWOOD. Brooklyn Med. Journ., 1906, xx, 62. Reports case of rupture of spleen. Operation in 3 or 4 hours. Hemorrhage all back of peritoneum and no free blood in peritoneal cavity. Spleen and clot left undisturbed and wound closed. Patient recovered.

12. DAVYS. Indian Med. Mag. Calcutta, 1904, xxxix, 219. Reports spontaneous rupture of spleen in native while lying down. No accident. Died in  $\frac{1}{2}$  hour. Postmortem: Spleen has rent in anterior angle; is soft and enlarged to double its size. No pathological report.

13. THURSTON. Ibid. p. 379. Reports operation for peritonitis. Ruptured spleen. Spleen not enlarged. The blood had become encysted, the breaking of which caused the peritonitis. No free blood in abdominal cavity.

The evidence upon which a diagnosis can be established is the history of traumatism to the upper abdomen and especially when applied to the left side; shock, pain, tenderness over the spleen, rigidity of the recti muscles, more marked of the left; later signs of hemorrhage and meteorism. The abdominal wall rarely shows the evidence of force, although it be sufficient to rupture any one or several of the abdominal organs. The absence of ecchymosis or bruising should not mislead one.

As we see these cases in the hospital the impression one receives is that the patient has a serious hurt and urgently requires operation, and it is my opinion that the time spent in making a fine differential diagnosis would be better spent in opening the abdomen on the evidence of a ruptured viscus and repairing the condition or conditions found.

If the diagnosis of injury to the spleen can be established an incision through the left rectus muscle offers the best route for handling the conditions. Unfortunately the signs of hemorrhage into the peritoneal cavity and the meteorism so often obscure the symptoms that we must make a compromise incision, that through the right rectus muscle being the best. The umbilicus should be on a line with the middle of the incision. One can readily and rapidly enlarge upward and downward. Injuries to other organs will be more readily seen and recognized by this route.

## GANGRENE OF THE GALL BLADDER.

BY ANDREW STEWART LOBINGIER, M.D.,

OF LOS ANGELES, CAL.

THIS comparatively rare condition has been mentioned by all of the prominent writers on the diseases of the gall bladder, but there have been singularly few cases reported in literature. In conversation with a number of surgeons here and abroad, whose wide experience in the pathology of gall stone disease is a matter of international note, I have been surprised at the few instances of true gangrene of the gall bladder which have fallen under their observation. This fact and certain unusual features in the pathology, would seem to make the case here reported one of some scientific interest.

CASE.—F. J., Teuton, age 55, married. He was first seen February 26, 1906, by Dr. Paul Adams, by whose courtesy I was permitted to see the patient. The family history was negative. Until recently he had been a resident of Brooklyn, N. Y. Up to five years ago he had been a hard drinker, chiefly whiskey. On Oct. 15th, Nov. 15th and Nov. 29th, 1905, he had suffered severe attacks of pain in the region of the gall bladder. These attacks, which were supposed to be gall stone colic, developed and disappeared very suddenly and left the patient prostrated. Jaundice, more or less persistent, had been present for more than three years. Early in the history of the case he was said to have sugar in the urine and an excess of urea.

When first called Dr. Adams found the patient suffering severe pain in the region of the gall bladder. These pains radiated downward, as well as upward toward the right scapula. The liver was somewhat enlarged extending an inch below the costal border. There was marked tenderness on light pressure over the gall bladder. The heart showed a moderate systolic murmur. There was a well marked jaundice, and bile and a trace of albumen were found in the urine. At this time the temperature was normal and the pulse 90, but the patient felt sure the pain he was suffering was more severe than in any previous attack. I

was called in by Dr. Adams on March 1st. The patient was a large plethoric subject with jaundiced skin and conjunctivæ. His temperature was then 102.4° F. and the pulse 118 and he had had several rigors. He complained of a severe pain in the right hypochondrium which extended through to the back. The right rectus was rigid and there was a dense mass in the region of the gall bladder, which was only slightly tender on firm pressure. The diagnosis was suppurative cholecystitis with localized peritonitis, and immediate operation was advised.

The operation was at the California Hospital on March 2nd. The gall bladder, which was several times the normal size, was gangrenous and distended with gas. It was covered and walled off from the peritoneal cavity, by the gastrohepatic and a portion of the great omentum. Surrounding the gall bladder was a pool of dark slate-colored purulent fluid. The omentum was deeply injected and stained by this dark fluid. The fluid was sponged away and the gall bladder opened. It contained gas only; the walls were moist and were distinctly emphysematous, crackling under pressure between the thumb and finger. The mucosa easily separated from the wall and both were gangrenous. In the upper portion of the cystic duct was an irregular stone about the size of a small hazelnut, imbedded in sand and gravel like millet seeds. No other concretions were found. The common and hepatic ducts were probed and found clear. The gall bladder was freed of further adhesions and removed, a drain being placed in the remaining portion of the cystic duct. A pocket above and one below the former position of the gall bladder were drained with cigarette drains. The convalescence was not marked by any unusual incident and the patient left the hospital March 16th. A slight mucus discharge continued for several weeks from the drainage fistula.

The feature of especial interest in this case is the emphysematous condition of the gall bladder wall and the distention with gas of the bladder itself. Of the bacterial flora present little can be said, as the material taken for smear and culture was accidentally destroyed. One might assume the presence of coli, probably the commonest form of gas producing bacillus incident to the gall bladder.

## THE TREATMENT OF THE APPENDIX STUMP AFTER APPENDECTOMY.\*

BY MURAT WILLIS, M.D.,

OF RICHMOND, VA.,

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THE method of disposing of the stump of the appendix has often been said to be the only unsurgical feature in the operation for appendicitis. As a topic of discussion, this question almost invariably arises when two or more surgeons meet together, and I have been particularly impressed by the interest shown in this subject at various medical meetings and in the clinics that I have visited. Furthermore, this subject has formed the basis of several articles in the current medical literature, and as some of the writers' conclusions are at such variance with my ideas on the subject I determined to communicate with a large number of representative operators in this country, and to tabulate and analyze their replies. In accordance with this plan, and at the suggestion of Dr. George Ben Johnston, letters were sent to one hundred and twenty-five surgeons, including all the members of the American Surgical Association, and other well known operators, so as to obtain a general and impartial view of the subject. Each of these men was requested to answer the following list of questions:

1. Do you crush or ligate stump?
2. Do you divide with knife or cautery?
3. Do you use any chemical in disinfecting?
4. Do you bury the stump? (a) If so, how? (b) If not, why not?
5. Have you observed any difference in the intensity or character of pain between cases when the stump is buried or unburied?

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\* Read before the Southwest Virginia Medical Society, Jan. 16, 1908.

6. Have you seen any ill effects arise from unburied stumps, if so, what?

7. Have you observed any harmful effects of any character from burying the stump?

One hundred and five replies have been received and the analysis of these reports has proved most interesting.

The answers to the first three questions show the minor differences of technique practiced by different operators: Forty-eight both crush and ligate the stump; 29 ligate without crushing; 13 crush but do not ligate; 7 either crush or ligate; 4 neither crush nor ligate.

In answer to question 2, the appendix is divided by the cautery by only 11 operators. The remaining number use either the knife or scissors.

Many surgeons evidently believe in the attempt to disinfect the stump: Thirty-eight use carbolic acid; 15 use carbolic acid followed by alcohol; 10 use carbolic acid occasionally but not as a routine; 4 use the cautery; 10 use chemicals other than carbolic acid or the cautery; 28 do not attempt to disinfect the stump.

The chief interest in compiling these statistics, however, lies in the answer to question 4. The analysis of the 105 replies show that 77 *always* bury the stump, 66 by ligating and inverting into wall of cæcum, 11 by invaginating the unligated stump into the cæcum; 11 *usually* bury the stump (leave unburied only in drainage cases); 3 have no settled method; 2 leave no stump; 11 never bury the stump; 1 does not answer the question.

Thus it appears that the stump is always buried by 73.3 per cent. and usually buried by 10.5 per cent. of the representative surgeons in this country, while only 10.5 per cent. make a practice of never burying the stump.

Post-operative pain has been stated by different writers as a defect in the different methods of handling the stump. Of 103 replies to question 5, 78 have observed no difference whether the stump was or was not buried; 20 are unable to answer (personal observation on only one method); 3 state

that pain is greater when stump is buried; 2 state that pain is greater when stump is left unburied.

In reply to question 6, 23 of the 105 reports make mention of untoward results that have followed simple ligation and leaving the stump unburied. The remaining answers state that they have not personally observed any ill effects, or else have had no occasion for observation because of the reason that they have never left the stump unburied. It seems worth while to mention in more detail these replies.

(1) Four cases of intestinal obstruction from adhesions of the bowel to the stump, two of which were fatal—Armstrong, Montreal.

(2) Many temporary fæcal fistulæ—Bevan, Chicago.

(3) One case of fatal peritonitis, one case of fæcal fistula—Blake, New York.

(4) Occasional fæcal fistula—Bryant, New York.

(5) Several cases with very bad adhesions, one case of persistent suppuration—Estes, South Bethlehem, Pa.

(6) One case slipped ligature—Gerster, New York. (Operation by a house surgeon.)

(7) One case adhesions on reopening abdomen—Gwathmey, Norfolk.

(8) One case stump leaked, abscess—Harris, Chicago.

(9) Occasional fæcal fistula—A. B. Johnson, New York.

(10) Post-operative adhesions common—H. A. Kelly, Baltimore.

(11) Two cases of ileus from adhesions—MacLaren, St. Paul.

(12) One case slipped ligature, peritonitis, death—Matas, New Orleans.

(13) Fæcal fistulæ common—Monks, Boston.

(14) One case of abscess, death—Munro, Boston.

(15) Three cases of intestinal obstruction from bands adherent to stump—Oliver, Cincinnati.

(16) Fæcal fistulæ, slow healing, oftener infection—Owen, Chicago.

(17) One case stump sloughed, death, autopsy—Rixford, San Francisco.

(18) Occasional fæcal fistula—Senn, Chicago.

(19) One case Fallopian tube found adherent to appendix stump—W. J. Taylor, Philadelphia.

(20) Persistent sinuses—Vander Veer, Albany.

(21) Fæcal fistulæ common—Watson, Boston.

(22) Fæcal fistulæ commonly result—Weir, New York.

(23) Fæcal fistulæ more common—Willard, Philadelphia.

In striking contradistinction to the many complications following the practice of leaving the stump unburied, I am very much impressed by the fact that in the replies to question 7, only 2 surgeons out of 105 state that they have ever observed harmful effects of any character after burying the stump. These are as follows:

(1) "In one case a stitch gave way during the first defecation (after calomel) and a large exudate developed with symptoms of perforation. The exudate, however, was absorbed and the patient recovered"—Gerster, New York.

(2) "Two secondary abscesses"—Mumford, Boston.

Intestinal hemorrhage following invagination of the unligated stump has been reported frequently in the current medical literature. Although no inquiry was made in my letter as to the incidence of hemorrhage, yet it is of interest to note that 10 of the 105 replies contain statements in regard to this point. Several of these operators say that they have seen hemorrhage in the practice of their colleagues; but in addition not a few interesting personal cases are cited, in several of which the abdomen had to be reopened because the patient was almost pulseless. Several deaths from hemorrhage are reported in this series.

Although comment is hardly necessary after merely tabulating these statistics, yet attention may be directed in a brief way to several points.

*Post-operative pain* is one of the arguments advanced by the exponents of the unburied stump. The brilliant researches of Lennander, however, on the absence in the visceral peri-

toneum of nerve fibres which convey the sense of pain, serve to thoroughly invalidate this assumption, and in full agreement with this is the clinical experience of the vast majority of operators.

*Infection*, and *abscess*, after burying the stump would seem from the analysis of these replies to be regarded in the light of a theoretical rather than practical objection to this method. It is to be noted that only 2 of the 105 operators, including the 11 who believe in leaving the stump unburied, report that they have observed any sequela of this character when the stump is buried, while no mention is made of any fatalities from this source.

*Adhesions* following burying the stump are not reported in a single reply, although in some of the articles by exponents of the unburied stump the liability of adhesions to the region of the buried stump is one of the objections to this procedure. That adhesions do occur when the stump is left unburied is only too apparent by the number of cases of intestinal obstruction reported in these statistics which were found to be due to adhesions of the unburied stump to the omentum, small intestine, or abdominal wall.

The chief objections to leaving the stump unburied appear in nearly one-fourth of the 105 replies. They are: (1) obstruction to the bowel; (2) slipped ligature, with escape of fecal contents into the abdominal cavity; (3) adhesions of the raw surface of the stump to omentum, abdominal wall, and various nearby viscera. Two personal experiences with the unburied appendix stump impressed me very forcibly with the defects in that method.

In the first case a myomectomy was done and a practically sound appendix was removed at the same time. As it was a perfectly clean operation, the appendix was ligated, amputated, and the stump allowed to fall back into the cavity. Two days after operation the woman developed post-operative distention of the bowel, the ligature was "blown off," with the escape of fecal contents into the abdominal cavity. Death occurred from general peritonitis, and the conditions as

described were confirmed at the autopsy. This case, to my mind, illustrates one of the most dangerous accidents that are liable to occur in any patient in whom the stump is simply ligated and not buried. Distention of the bowel may occur after any abdominal operation and it is easy to understand how the increased pressure within the bowel will balloon out the appendix stump into a pyramidal-shaped body, with the apex at the ligature, and the integrity of the bowel wall is thus jeopardized in every case in which any distention ensues.

Shortly after the above case was operated upon, a patient was admitted to Dr. Johnston's service with evident intestinal obstruction. Operation showed an unburied appendix stump adherent to the abdominal wall, and a kinking of the small intestine about this adhesion so as to cause a partial obstruction of the gut. The patient recovered after separating the adhesions, freeing the loop of intestine, and burying the appendix stump in the cæcal wall.

We always make it a practice to ligate and bury the stump of the appendix whenever practicable, and in following our results during the past three years I have never seen any ill effects that would lead us to make any change in our method of procedure.

I am very much indebted to the surgeons who replied to my letter and for the evident interest that they have displayed in this matter by personal letters and other communications.

## EXCISION OF CARCINOMA OF THE RECTUM BY THE COMBINED METHOD.

WITH REPORT OF THREE CASES.\*

BY JOSEPH A. BLAKE, M.D.,

OF NEW YORK,

Surgeon to Roosevelt Hospital.

THERE has been a distinct swing of the pendulum in the last six or seven years toward the combined method (the abdomino-perineal) for the removal of cancer of the rectum. As yet the comparative value of the operation cannot be said to be determined and therefore, the report of all cases treated by this method is still of interest.

Its completeness and thoroughness, the great desiderata of operations for carcinoma, are its chief qualifications for merit and, at the same time, its chief drawbacks, on account of the greater danger incurred. It remains to be proven whether the results in regard to recurrence are sufficiently better than by other methods to justify the additional immediate operative risk.

It seems to me that no definite procedure should be considered desirable for all cases but that the operation should be designed to meet the indications in each individual case. To be more explicit, I would perform the perineal operation in early and low lying growths in which the anal sphincteric control can be preserved and, in general terms, would reserve the combined method for larger and higher growths which otherwise would have to be approached by the sacral route and for those in which the anal sphincters have to be sacrificed. This statement, while in general terms correct, has to be further modified, as will appear later.

I also believe that, when employing the combined method, all hope of preserving the natural site for the outlet of the in-

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\* Read before the New York Surgical Society, March 11, 1908.

testine should be relinquished and that a permanent abdominal anus should be at once instituted. Exceptions to this last statement may occur in rare instances when it is exceptionally easy to draw the bowel down through the preserved sphincters. My reasons for preferring the establishment of an abdominal anus is that by this procedure the entire operation is rendered aseptic whereby the abdominal wound can be entirely closed and the perineal almost completely and with the minimum of drainage, advantages which are inestimable when the vitality of the patient has been lowered by a prolonged operation. For, if after removing the growth through the abdominal incision, the oral is united to the aboral segment either by the Maunsell method or through a parasacral incision, a second division of the bowel becomes necessary, the avenues of infection are opened and the operation is unduly prolonged. Even if the sphincter can be preserved, as in the Quénu method, the fixation of the oral end between its divided halves, consumes more time than the institution of an abdominal anus and introduces the element of infection into the perineal wound. Furthermore, in using the Quénu method, the temptation is always present either to divide the intestine too near the upper limit of the growth or to put it on too much tension, thus endangering its blood supply.

While it is often difficult to get the patient's consent to an abdominal anus, although it is far more efficacious and cleanly than an incompetent perineal or sacral one, I have felt so strongly about it that I have refused to operate unless I had consent for an abdominal anus in cases where the combined operation seemed best.

The advantages of the combined method have been dilated upon so often in various papers that it seems almost needless to repeat them. Besides, the opportunity of a far more radical removal than is possible by other methods, the chief advantages seem to me to be: first, that the abdominal approach permits a much fairer estimate as to the possibility of removal and, if on account of lymphatic or metastatic extensions, it is found to be impossible, the patient is spared a mutilating and danger-

ous operation: and secondly, that the convalescence may be much shortened on account of aseptic healing, as has already been mentioned.

The three following cases illustrate fairly well the above arguments.

CASE I.—Mrs. G., manicurist, aged thirty-two years, was admitted to the Roosevelt Hospital in May, 1905. For two years she had had hemorrhage from the rectum, the last amounting to a pint, on the day of admission. For two and one-half years she had had increasing constipation. For two years pain, chiefly when at stool. She had had one child two and a half years before admission, the delivery being instrumental. Local examination revealed a large mass two inches above the anus, filling the rectum. It was fixed, lobulated and soft and friable, bleeding freely. Neither a tube or enema could be made to pass through it. Numerous indentable masses were felt throughout the abdomen. There was a small umbilical hernia. The heart, lungs and urine were negative. The general nutrition was poor. The tongue was coated but moist. The red cells were 3,800,000. Temperature was 98.8, pulse 88, respiration 22.

Operation, three days after admission. Nitrous oxide, ether anesthesia. Trendelenberg position. An incision four inches long, was made through the linea alba to the pubes. The mass was found to extend upward to above the middle of the sacrum. No lymphatic involvement was made out. The intestine was divided at the lower part of the sigmoid flexure; the ends inverted and the oral end brought out through an intermuscular incision just within the left anterior superior spinous process of the ileum, and fastened there with a few sutures, the end being left unopened. The aboral end was then drawn down over the pubes, the superior hemorrhoidal vessels ligated, the reflections of the peritoneum divided with scissors on either side and then across the front of the rectum at the bottom of Douglass' cul de sac. The bowel was then freed down to the levators by blunt dissection. So far, the operation was practically devoid of hemorrhage. The abdominal wound was then covered with a moist towel and the patient placed in the lithotomy position. The anus was closed with a heavy purse string suture of silk and then its external surface cauterized with the Pacquelin cautery. The region was recleansed

and a sagittal incision made circumscribing the anus from the perineal body in front nearly to the tip of the coccyx. The dissection was carried up, removing the sphincters with the rectum and the bowel drawn down and out. The perineal wound was then repaired by suturing the levators together with catgut and the more superficial portions with catgut and silk worm gut, a tube being placed in the posterior angle for drainage. The patient was then again placed in the Trendelenberg position, the peritoneum repaired at the bottom of the pelvis and the abdominal wound closed with a tier suture without drainage. Time of operation, two hours and twenty-six minutes. She was returned to the ward with little shock. Temperature 98°, pulse, 120, respiration 40.

The post-operative course was exceptionally smooth; there was a reactionary rise of temperature to 101.8°, which immediately subsided to normal and remained so. The wounds healed per primam with the exception of slight infection about the drainage tube in the perineal wound. The intestine was opened at the artificial anus at the end of thirty-six hours. She was allowed up on the nineteenth day. The portion of intestine removed was distended and hardened in formalin. On longitudinal section it showed a remarkable valvular arrangement of the neoplasm. It involved three and one-half inches of the rectum, invading the perirectal tissues somewhat toward the hollow of the sacrum, and consisted of a number of dendritic masses filling the lumen and folded downward so that the fecal current could pass downward, but not even water could be injected upward. On section, it showed the structure of a malignant adenoma.

I have been unable to follow this patient further than that she was reported in good health six months after the operation.

The most noteworthy feature of this case was the remarkably smooth convalescence. The operation was very long, unnecessarily so, it being the first case I had done by this method. In my second case the length of the operation was shorter by nearly an hour. In this case, however, I was able to close the peritoneum over the intestine in the floor of the pelvis before it was removed and could, consequently, close the abdominal wound, the transfer of the patient from the

lithotomy back to the Trendelenberg position thus being saved.

CASE II.—Mr. W., a farmer, aged sixty-six years, was admitted to the Roosevelt Hospital in June, 1906. He had had hemorrhages from the rectum for one year and pain for six months. Obstruction had not been marked. He had been cauterized for piles. He had gradually lost flesh and strength. He had had pneumonia five years before, otherwise his previous and family history was negative. Local examination revealed an ulcerated growth in the anterior wall of the rectum, extending from just above the anal canal upward for a distance of three inches. It did not obstruct. His general condition was unfavorable. He was emaciated, somewhat anæmic; the heart sounds were feeble; the arterial walls thickened; the lungs emphysematous; the abdomen negative; the tongue coated; the urine contained a trace of albumen and a few hyaline casts; hemoglobin 75 per cent.; red cells 4,600,000. Temperature 98°, pulse 108, respiration 24.

Operation: Nitrous oxide gas anesthesia; time, one hour and thirty-five minutes. The same procedure was carried out as in the preceding case except as has been already stated, the abdominal wound was closed before removing the rectum through the perineal incision. In this case the levators could not be sutured together. Drainage was by a cigarette drain instead of by a tube as in the preceding case. The operation was followed by considerable shock and he was given an infusion, but at no time did his condition seem to be precarious. The highest temperature, 101.6°, was reached at the end of twenty-four hours, but immediately fell to normal, fluctuating between 99° and 101° for six days, after which it remained normal. The pulse fluctuated between 88 and 112 on the second day. The abdominal wound healed per primam but the cigarette drain did not drain properly and there was some infection of the perineal wound and about one-third of it healed by granulation. He was rather feeble and convalesced slowly but surely and was discharged, healed, at the end of five weeks.

The growth proved to be adeno-carcinoma.

He remained well for about twelve months and then failed rapidly, dying at the end of fifteen months, of "internal cancer," there being no evidence of intestinal recurrence.

This patient ordinarily would be considered an unfavorable subject for any operation, yet stood it well and made a satisfactory operative recovery.

In the following case a preliminary artificial anus became necessary on account of the development of acute obstruction resulting from perforation and proctitis. It also illustrates under what difficulties the operation is possible.

CASE III.—Miss R., forty years of age, was admitted to the Roosevelt Hospital on July 9, 1907. The only history obtainable from her was increasing constipation for a period of six months, followed four days before admission, by a sudden stoppage and a feeling of discomfort in the rectum. Cathartics were taken without relief, but gas and small quantities of feces were obtained by enemata which were only given with difficulty. On admission, there was a growth extending from the upper portion of the anal canal upward, blocking the rectum and involving the posterior vaginal wall. It seemed to be immovably fixed but was not particularly sensitive. Her general condition was fair, red blood corpuscles 3,600,000, hemoglobin 80 per cent., leucocytes 12,200; polymorphonuclears 89 per cent., temperature 100.6°, pulse 98, respiration 24.

She was kept for five days under observation, the intestine being gradually emptied by irrigations and enemata. The obstruction seemingly increasing, an inguinal colostomy was done, the gut being opened on the second day after operation. When under ether, the growth was carefully examined and found to be fixed and apparently extensively infiltrating, which condition was afterward proved to be largely due to proctitis. Two days later this became more evident and the abscess was opened by an incision lateral to the anus. The abscess extended to above the levators but gradually cleared up, when it was found that the growth, although extensively infiltrating, could probably be removed, which was done two weeks from the institution of the colostomy. Under nitrous oxide, ether anesthesia, the colostomy wound being isolated with rubber tissue, a five inch median incision was made, the patient being in the Trendelenberg position. The intestine was divided far enough below the colostomy to allow inversion and the remainder of the intestine with the growth, removed in the same manner as in the first case reported.

The perineal excision, however, was much more extensive, including the entire posterior vaginal wall, the ischioirectal fat and the greater part of the levatores ani muscles. The resulting cavity seemed enormous and was closed with difficulty. The operation consumed two hours and thirty minutes, being prolonged rather than otherwise, by the presence of the colostomy. She was returned to bed in marked shock, the pulse being 140 and the temperature 96°. She responded well to heat and an infusion. The highest temperature, 100.4°, was reached on the second day, but after that remained normal. Healing of the abdominal wound was immediate but the perineal wound closed slowly by granulation. She, however, left the hospital within three weeks with a small granulating sinus.

Examination of the specimen showed that a perforation had occurred at the upper limit of the growth which caused the proctitis and sudden obstruction. The difficulties of excision were greatly increased by the presence of this suppurating sinus and it seemed remarkable that healing of the perineal wound occurred as rapidly as it did. The entire absence of sepsis following the operation is also noteworthy. The after-course of this patient, however, was far less favorable. A pulmonary metastasis appeared four months after operation, she dying two months later. The metastasis evidently was due to implication of the systemic veins in the tissues outside of the rectum. There was no local recurrence. The growth was an adeno-carcinoma.

These three cases throw little light on the curative value of the combined operation. In regard to the immediate operative risk, they impressed me strongly with its comparative safety. Although the shock may be great, the entire exclusion of the element of infection by means of the institution of an abdominal anus remote from the operation wounds, is greatly in its favor. Although patients are momentarily depressed by the severity of the operation, there is nothing in the condition of the wounds to interfere with convalescence. The dangers of the operation therefore, are restricted to the ordinary ones of shock and the anesthetic, it only being necessary that the technique should be good to practically ensure success. My own experience and that of others, shows that the mortality

of the low operations is largely caused by sepsis. In personal communications with other surgeons, I have gained from them the impression that their mortality in the combined operation is higher than in the parasacral route. I am inclined to attribute this to the fact that in many of their cases, complicated suture operations are done, the abdominal anus not being resorted to. There are certain cases in which the combined operation should be avoided if possible, notably obese males, in whom all abdominal operations are attended with great danger, but particularly this one, on account of the difficulty of handling the fatty intestine in a narrow pelvis and the large incisions necessary. Moreover, women, not only on account of the roomier pelvis but because of their insusceptibility to pelvic invasions, are far better fitted for this operation than males.

A résumé of my present opinions in regard to this subject may be briefly stated as follows:

That no single operative procedure for carcinoma of the rectum should be always carried out to the exclusion of others.

That the decision between the perineal and combined methods depends chiefly upon the feasibility of preserving the efficiency of the sphincter ani muscle, provided the growth is removable by the low route.

That when the combined method is used, an immediate abdominal anus should be formed unless the continuity of the natural passages can be restored with exceptional facility.

That institution of a colostomy at a previous operation is an embarrassment rather than an aid.

## THE DIAGNOSIS AND PROGNOSIS OF TUBERCULOUS AND SEPTIC CONDITIONS OF THE KIDNEY.\*

BY GEORGE E. ARMSTRONG, M.D.,

OF MONTREAL, CANADA.

COMPARATIVELY recent and more exact methods of determining the organic changes in and functional values of the kidneys together with the experimental researches of Hanau, Baumgarten and his pupils, Hansen and Guiani, as well as those of Wildbolz, have added materially to our knowledge of the diseases of these organs and to our therapeutic resources. The kidneys are, in the majority of cases, the first of the urinary organs to be infected by the tubercle bacillus. That one kidney alone may be affected at first, the other remaining free for a considerable time is a fact established by a large number of observations. It is with these cases of unilateral renal tuberculosis that we as surgeons are chiefly concerned, and this class includes according to Garrè and Erhardt about 10 per cent. of the tuberculous diseases.

Between June, 1905, and February, 1908, I removed 11 kidneys; 8 of these were tuberculous and 3 were cases of non-tuberculous pyonephrosis. Five of the patients were females and 6 were males. Of the 8 tuberculous cases 5 were males and 3 were females. The age in the tuberculous cases was from 21 to 41, the other 3 cases were aged respectively 48, 49, and 55.

The first symptoms in 3 of the 5 males were vesical tenesmus, frequency of micturition and hæmaturia. In one, frequency with pain but without blood, and in one, a sudden stoppage of the stream, followed by frequency. In the 3 women the first symptom was pain in the loin. Loss of weight was never a conspicuous symptom, although one patient had lost 30 pounds. Cystitis was present at the first examination in 6 cases; in 2 it was confined almost exclusively to the half

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of the bladder on the diseased side. In 4 cases there were present at the first examination a distinct ulcer around the ureteral opening in the bladder on the diseased side. In one case the ureteral opening in the bladder was swollen and cedematous, but not ulcerated. Tuberculous epididymitis was present in two cases. The relative dates of the development of the disease in the kidney, bladder, and testicle could not be determined.

The diagnosis was made in each instance by examining the individual separate urines from each kidney, and finding tubercle bacilli in the urine from the diseased side. This examination was also made to demonstrate the presence of a second kidney and the functional value of each kidney separately. The findings in 4 of these cases have been published in the "Montreal Medical Journal," and are referred to by Dr. R. P. Campbell in his paper published in the *ANNALS OF SURGERY*. The details of the remaining 4 cases are as follows:

A. B., aged 29; English cotton-mill operative; married. Was admitted to the Montreal General Hospital for pain in the right loin of 6 or 7 weeks' duration. Slight at first and of a dull, aching character, it gradually became worse and compelled her to give up work. She had lost in weight. Her nutrition was poor—mucous membranes pale. In the right loin was a mass which could be easily palpated and which was, apparently, an enlarged prolapsed kidney somewhat tender on pressure. Amount of urine excreted in 24 hours  $32\frac{1}{2}$  oz. It was found impossible to catheterize the right ureter. The urine from the left kidney was drawn by a ureteral catheter, and that from the right was obtained from the bladder. From the right kidney came only pure pus, in which no tubercle bacilli could be found. Around the orifice of the right ureter was an ulcer. The urine from the left kidney was as follows:

Left Kidney	
Sp. gr.	1015.
Reaction	Acid.
Urea	8 grs. to 1 oz.
Alb.	Trace.
	Sugar present after phloridzin.
	No tubercle bacilli.
	Cocci.

The right kidney and ureter were removed and the patient made an uninterrupted recovery. A year afterwards she was confined in the Montreal Maternity Hospital, when an examination of the bladder was made and the ulcer was found completely healed. The woman seemed in perfect health. The removed kidney was large, with scarcely any renal tissue left. It was composed of large pockets filled with pus. The pathologist's report was "Tuberculous pyonephrosis."

The 6th case. W. J. K., aged 41.—Complained of frequency of micturition. Had had appendicitis 18 months before, and the appendix was removed. His first symptom was in the fall of 1906, when a sudden stoppage of the stream was noticed, but it soon started again. Pain sometimes felt in the penis and the bladder, with increased frequency day and night. Has never noticed blood in the urine, which, however, has gradually become muddy and thick. During the summer of 1907, felt a pain in his loins. Has lost in weight. No history of fever or night sweats. Cystoscopic examination shows acute cystitis over the left side of the bladder with mucopus and doubtful-looking tubercles, more especially about the left ureteral orifice, which is very red, wide open and irregular in shape, slightly ulcerated, and in normal position. The right orifice is normal and the right side of the bladder is almost quite healthy in appearance. The bladder holds 6 oz. with difficulty. Neck of bladder bleeds quite easily. Ureters were catheterized and the urine gave the following analysis:

	Right Ureter	Left Ureter
Reaction	Acid	Alkaline.
Color	Clear, yellow	Pale, watery.
Sp. gr.	1026	1006.
Urea	2.9 per cent.	.6 per cent.
	Blood cells (traumatic)	Numerous tubercle bacilli.
	No pus	Pus in quantity.

The kidney was removed on January 31, 1908. Adhesions were considerable. The kidney was enlarged, rough in appearance, and the capsule adherent.

The 7th case, Mrs. J. S. C., aged 33; married; has had 2 children. Pulmonary tuberculosis diagnosed in March, 1905. Pain in the left kidney about the same time. Never had any

hæmaturia. Pus in the urine was first discovered in April, 1906. The examination of the urine gave the following:

	Common	Right	Left
Color	Turbid	15 c.c. Slightly cloudy	5 c.c. Bloody.
Reaction	Acid	Acid	Alk.
Sp. gr.		1018	Not taken.
Urea		2 per cent.	No urea.
Albumin	Alb.†	Tr.	Alb.†††
Pus	Pus	A few cells.	Almost pure pus
Tubercle bacilli	Tubercle bacilli present	No tubercle bacilli	Tubercle bacilli present
Staphylococci		Staphylococci.	

On palpation the left kidney was found to be enlarged to nearly the size of a child's head and tender on pressure. The pulmonary lesion is reported to be perfectly healed. The discomfort in the left side is considerable, and the bladder irritation extreme. Micturition sometimes as often as every 20 minutes, and as often as 20 times in the night, accompanied by pain and occasionally a speck of blood.

I removed the kidney and the patient made a very smooth and uninterrupted recovery. In 4 weeks the pain associated with micturition had entirely disappeared and the intervals had increased to 3, 4, and sometimes 5 hours, and on one occasion 6½ hours.

The 8th case, M. W.; female, aged 30.—Early symptoms simulated nephrolithiasis. An examination of the urines at this time, September 17, 1907, gave the following:

	Right Ureter	Left Ureter
Sp. gr.	10 c.c. 1012	10 c.c. 1022.
Reaction	Acid	Acid.
Color	Straw	Blood.
Urea	1.8 per cent.	2.6 per cent.
	Alb.	Alb. tr.
	12 m nec. to red. 1 c.c. of Fehling	3 m nec. to red. 1 c.c. of Fehling.
	Δ—.61	Δ—1.46.
	Pus in quantity	No pus.
	No tubercle bacilli	Red blood cells traumatic.
	Large and small bacilli	

A diagnosis of stone was made and one of my colleagues did a nephrotomy. The pelvis and calices were dilated and a cavity was present in the upper pole but no stone was found. A sinus persisted and small perinephritic abscesses formed and were opened from time to time. The case seemed clinically to resemble very closely the condition described by Brewer as "Acute unilateral hæmatogenous infection of the kidney." On the 28th of November, 1907, the urines were as follows:

	Right Ureter	Left Ureter
Sp. gr.	1012	1022.
Reaction	Acid	Acid.
Urea	.6 per cent.	2 per cent.
	Pus	None.
		A few red blood cells (traumatic).
	$\Delta$ —.75	$\Delta$ —1.14.

I removed the kidney on the 6th of December, 1907, and the pathological report was that it was tuberculous, the pyogenic infection being secondary.

The chemical reaction was in each instance alkaline. The urine from the diseased kidneys was never acid; in 3 the urine was alkaline and in 2 neutral. In 3 cases, only pus was obtained. As acid reaction is a characteristic of tuberculous pyuria and a neutral and alkaline reaction an evidence of mixed infection, it follows that in every case there was a mixed infection at the time of examination. A disagreeable odor was generally present in those that gave an alkaline reaction.

After establishing a diagnosis of tubercle in one kidney, it becomes necessary to estimate, if possible, the extent of the disease, the functional value of the kidney and also to demonstrate the presence of a second kidney and its functional value. In the very earliest stage it is often difficult to find tubercle bacilli. They may be few in number. In the late stages, when the kidney is little more than a pus sac they seem to have died out, and to be difficult to find in the pus coming from the kidney.

These results correspond closely with those of Ekehorn, who found bacteria relatively few in number in old cases in which the kidney after extirpation was found to be little more

than a pus sac with sclerotic walls and thin pus. The urine in such cases is very purulent and the bacteria few in number.

He reports a case of a woman 30 years of age who came into the hospital in 1902, with a diagnosis of tuberculosis of the left kidney. Numbers of tubercle bacilli were present in the urine—the disease was relatively recent. She was a strong able woman, and would not submit to an operation while she was free from pain. She left the hospital improved, and having gained 3 kilos in weight. In 1904, she was re-admitted to the hospital. During this period of 2 years she had worked hard and felt well. Her only complaint was of frequent micturition. The tubercle bacilli in the urine were few in number and the pus greatly increased in quantity. The extirpated kidney was found to be in a condition of fully developed tuberculous pyonephrosis with thin fibrous walls.

Another of his cases was that of a young woman aged 22, with tuberculosis of the right kidney. In June, 1906, after lifting a heavy load she suffered for a few days from a painful feeling in the right lumbar region. She felt the pain only when she bent forward or straightened up. It was not sufficient to prevent her from continuing with her usual work, and in a few days she felt quite well. On the 5th of October, 1906, blood appeared in the urine, and at the same time right renal colic—generally two attacks a day, each one lasting 15 or 20 minutes. This sometimes continued for a week, when she seemed to recover perfectly, and could do her work as usual. On the 16th of November blood reappeared in the urine, but without pain. There were no bladder symptoms. In the urine were found pus-cells and numerous tubercle bacilli with only a trace of albumin. The number of tubercle bacilli in this case was great, while the number of pus-cells was small with here and there a red blood-cell. Only 6 c.c. of urine came from the right ureter during an hour. The urine was not pale, but had a normal color. That from the left kidney was quite normal. The kidney was removed on the 23rd of November, 1906, and the extirpated kidney showed comparatively small changes. When the kidney was split it appeared for the most part sound. The chief changes from the normal were found in the three papillæ.

Ekehorn draws the following conclusions: Numerous bacilli may be found in the urine in very early cases and the number of bacteria found at different times vary during the different periods of the disease. When a new part becomes involved, the bacteria are more numerous. With numerous bacilli there may be a small quantity of pus and with a large amount of pus the bacteria may be relatively few in number. When the pus is in large quantity and the bacteria few, the lesion is probably an old one with cavities and sclerotic walls.

If the pus in the urine is insignificant, then it is probable that no very large part of the kidney is involved, although many bacilli may be present.

The functional value of the diseased kidney is difficult to determine with certainty. A small amount of disease may materially lower its efficiency. This is very well shown in one of my cases where the kidney involved excreted urine turbid in color and neutral in reaction, sp. gr. 1.007, urea 1.1 per cent., and only a trace of albumin—sugar present and a freezing point of  $-0.35^{\circ}$ —pus and tubercle bacilli. When the kidney was removed nothing was evident on or beneath the capsule, nor, indeed, was it at first apparent after longitudinal section had been made from pole to pole. On a more minute inspection one calix was found where all the points of the pyramids projecting into it showed macro- and microscopically typical tubercle formation. Hæmaturia had been a prominent symptom in this case. The kidney was removed because the hemorrhages were so large and recurred so frequently that he was becoming decidedly anæmic.

To establish the diagnosis pus must be found as well as tubercle bacilli, as in patients suffering from pulmonary tuberculosis the urine may contain tubercle bacilli and yet at autopsy no alteration in the kidneys be found. This has been noted by Jani and Schuscharadt and others.

The determination of the functional value of the other kidney is of great importance and the results in my cases based upon an examination of the urine from this kidney have been found to truly indicate its efficiency.

LIEK, however, reports a case where such was not the case. The urines from the two kidneys in Liek's case were as follows:

Right	Left
15 c.c.	50 c.c.
Clear	At first turbid, later clear
Mildly acid	Alkaline
No sediment	Very rich in leucocytes
No albumin	Trace of albumin
After 0.01 Phloridzin: after 20 min. good reaction.	After 22 min. sugar reaction
Fr. pt. not taken.	Fr. pt. $-0.60^{\circ}$

From these findings it was concluded that the right kidney was sound.

An operation was undertaken to remove the left kidney but the infiltration of the musculature was extreme, extended down to the true pelvis, and the kidney could not be made out. While searching for the left kidney the condition of the patient became so bad that the operation was abandoned and the wound tamponed. The patient died a few days later. At the autopsy, this right kidney, which had, seemingly, good functional capacity, was found very much enlarged, 3 or 4 times its normal size. After longitudinal section was made, the pelvis and calices were found very much dilated; the kidney parenchyma pale, yellow and containing many miliary abscesses. Microscopically it showed extreme changes about the parenchyma and interstitial tissue—cloudy swelling and necrosis of the epithelium, small-celled infiltration and miliary abscesses. As Liek remarks, the case would seem to indicate that these methods of determining the functional value of a kidney are only of relative value.

In a 21-year-old man suffering from rupture of the urethra and severe pyelonephritis of the left kidney, the right kidney gave a clear urine in sufficient quantity in typical intervals without sediment and without albumin. After the injection of 0.01 of phloridzin, good sugar reaction appeared in 20 minutes. The electric test seemed normal. From this examination the removal of the left kidney was considered. At the autopsy this, apparently, sound right kidney was found in a condition of extreme congenital deficiency and not sufficient to maintain the blood of proper density.

Descending renal tuberculosis would seem to be three times as common in women as in men. In 464 cases of Albarán, Facklam, König, Czerny-Simon and Vigneron there were 127 males and 337 females. The ascending form is confined almost exclusively to men.

The two sides are affected with almost equal frequency, although Küster, after examining a large number of cases, thinks there is perhaps a little preponderance of involvement of the right side and suggests the association of this condition with floating kidney.

There can be little doubt that renal tuberculosis is seldom, if ever, really primary. If it is true that 90 or 95 per cent. of all adults have, or have had, tuberculous lesions, it would certainly seem that the kidney involvement must be, as a rule, secondary to some glandular, pulmonary or other tuberculous lesion. Vigneron and Israel found secondary tuberculosis in

50 per cent. of cases of so-called primary renal tuberculosis. The kidney lesion may, however, be primary clinically, that is, it may be the primary lesion in the urinary tract and the only lesion active at the time, yet a careful study of autopsies renders it doubtful whether it is not in reality always secondary.

The bacilli are generally carried in the blood-stream, although the kidney may be infected by extension from adjacent tissues, particularly the peritoneum, and one cannot deny that possibly the infection may, in some instances, ascend from the bladder to the kidney. The preponderance of descending or hæmatogenous infection is well established by the studies of Steinthals, and Simmond's autopsy reports. Clinically, the renal may be of a truly primary focus. Of the primary lesion there may be no evidence as to its situation or even of its existence. Baumgarten's experiments indicate that tubercle bacilli never go against the stream either in the blood or in the lymph-vessels. He injected a highly virulent pure culture into the urethra of rabbits and attempted in that way to produce a tuberculous ulceration of the bladder and prostate, but he never got the infection to spread up to the kidneys or the epididymis. To produce an ascending infection of the kidneys, it was necessary, after injecting the ureter with the culture of tubercle bacillus, to put a ligature around distal to the injection, in that way arresting the flow of urine. There was the same difficulty in producing infection of the epididymis from the bladder. Albarran, Bernard and Salomon had the same experience, failing to cause changes in the kidney by injecting tubercle bacilli into the ureter until retention of the ureter was artificially produced by ligature. To produce infection of the testicle, the testicle itself must be injected, and then infection may pass along the duct to the prostate. On the other hand, Wildbolz seems to have succeeded in infecting the kidney from injection into the ureter without ligature.

Clinically the other kidney may become tuberculous after the first one. In these cases there is sometimes present a tuberculous cystitis with perhaps a tuberculous ulcer around the ureteral opening of the first side affected. In these cases

Tuffier thinks that the infection of the second kidney is an ascending one. This view seems to have some support from the recent experiments of Wildbolz, but it is not supported by Albarran, Bernard and Salomon, whose experiments would indicate that the second kidney like the first is a descending hæmatogenous infection.

There is little doubt that the cystitis is secondary to the renal infection in the great majority of cases. Just how long before the bladder becomes involved I have not been able to determine. Ulceration in the bladder seems to begin just at the entrance of the ureter through the bladder wall where there is a moderate narrowing as if the bacilli were detained at this narrow point and there get in their work. These ulcers are sometimes distinctly crater-like.

In one of my cases the bladder was examined 3 years after the onset of symptoms. Cystitis and ulcer were then present. There had never, in this case, been any pain or frequency. In the second case, although cystitis and ulcer were present, there were no symptoms. In the third case, symptoms of frequency and pain had been present for 6 months, and in the fourth for 8 months, and in these cases the bladder symptoms had been among the first and most prominent throughout the illness. In the fifth and sixth cases there was no cystitis and no ulcer; in the seventh and eighth the cystitis was confined almost entirely to the lateral half of the bladder on the diseased side, and in one of them, No. 7, there was also present an ulcer around the ureteral orifice of that side. In both Nos. 7 and 8, the opposite half of the bladder and opposite ureteral opening were normal.

I do not think that in the cases in which the bladder symptoms were primary the kidney lesion had been an ascending one. In two of them the kidney, when removed, was very extensively diseased, being little more than a pus-sac. The bladder symptoms rapidly improved immediately after the nephrectomy, and in the third although the kidney lesion was small the bladder immediately recovered, and has remained well ever since.

It would seem that renal tuberculosis may remain comparatively latent for a long time, giving rise to few symptoms perhaps for years. In the eight cases upon which I have operated the disease in the kidney was obviously much older than that in the bladder.

Five of my patients were males and two of them had an associated tuberculosis of the epididymis. In both of these cases there was also present cystitis with ulcer around the ureteral orifice. The time of incidence of these two conditions is not known because we have no knowledge of the time when the cystitis and ulcer appeared. It is altogether likely that in these cases the testicular infection is also hæmatogenous.

In 4 of Israel's cases there was besides the renal tuberculosis a tuberculous epididymitis without any disease of the bladder.

The combination of tuberculosis of the urinary and genital organs in women is a rare occurrence.

Küster thinks an ascending kidney tuberculosis is only possible by spreading from the mucous membrane or through antiperistaltic contraction of the ureters. This retroperistalsis has been observed, but it can take place only when there is a stricture in the lower end of the ureter analogous to the ligature applied by Albarran.

I have been unable to discover any predisposing cause in my cases. None of them had suffered from trauma, none of them admitted having had specific urethritis, in none of them was the condition obviously associated with floating kidney, and none of the kidneys removed showed any congenital lobulation or anatomical abnormality.

In 5 of these cases the kidney, when removed, showed very extensive caseation, breaking down of tissue in the centre and at both poles. In one the kidney was very hard and contracted; in one there was nothing outside of the kidney and but one calix where all the surrounding tissue was tuberculous, the disease spreading in the surrounding tissue to the depth of three-sixteenths to one-quarter of an inch, the whole disease

occupying about 9 c.c. of kidney tissue. In this case hemorrhage was a prominent symptom.

Zondek and Israel give an anatomical reason for the frequent involvement of the lower pole of the kidney, namely, the occasional existence of an artery springing direct from the aorta and going to the lower pole of the kidney so that the infection becomes localized.

In advanced cases I have found the fatty capsule altered, and very much adherent to the capsule of the kidney and in one it was indeed very difficult to separate it from the kidney.

Marked involvement of the ureter was present in two cases. The etiology of the changes in the ureter may vary in different cases, but the explanation given by Aschoff seems to harmonize very well with the clinical findings. Aschoff thinks that the involvement of the walls of the ureter is an ascending lesion, secondary to the ulcer in the bladder, the infection spreading upwards through the lymphatics from the ulcer at the ureteral opening in the bladder; the ulcer itself being a descending lesion.

Some cases have been reported in which the infection seems to have spread along the mucous membrane of the ureter by direct continuity from the pelvis of the kidney. In two of my cases all the coats of the ureter were involved. In one it was thickened and shortened raising the cornu of the bladder and rendering catheterization of the ureter difficult; in the other the walls were soft and friable—the ureter felt unusually large and œdematous.

Cases are reported in which ulceration of the mucous membrane of the ureter has been followed by cicatricial narrowing and even total obliteration.

The question of the frequency of involvement of the second kidney is of great interest. The following figures put together by Vigneron throw considerable light on this question: In 322 autopsies the disease was unilateral in 132 or 41 per cent.; in 326 operated cases the disease was one-sided in 198 or 60 per cent. These figures speak in a general way of the accuracy of the findings during clinical examination and

the operating table. By the time these people come to autopsy, it would naturally be expected that both sides would be involved in a much larger proportion of cases.

In another case many of the symptoms of tuberculous disease of the right kidney were present, namely, pain in the right loin and along the course of the right ureter, pain and frequency of micturition and pyuria, the patient gave a typical reaction to tuberculin, and no sign of any other focus could be discovered. Nevertheless no tubercle bacilli could be found in the urine. She improved under rest and dieting, and I did not recommend operation.

The temperature varies in these cases, and is generally elevated when ulceration of the bladder is present, but, as remarked by Garrè and Erhardt, it disappears almost at once after the kidney has been removed, although cystitis and the ulcer remain. They conclude that the only view to take of this is that the temperature was due to absorption of infected urine by the ulcerated surface.

There is nothing characteristic about the enlargement of the kidney in tuberculous disease. The enlargement is moderate in ordinary cases when due to caseation and excavation in the poles of the kidney. When a pyonephrosis develops the enlargement may be considerably greater. When one kidney is diseased and does its work imperfectly the other may undergo a compensating hypertrophy and the enlargement from this compensating hypertrophy has been mistaken for enlargement due to the disease and the wrong kidney removed. If ureteral catheter specimens are examined, this error can be easily eliminated.

The examination of the bladder is of interest and shows that the disease is first located at the ureteral opening on the diseased side and later in the trigonum.

In the diagnosis Garrè and Erhardt recommended palpation of the ureters through the rectum or vagina. Here one feels a distinctly thickened ureter on the diseased side as a tender cord. If all other methods of diagnosis fail, there remains exploratory incision and the treatment of whatever

condition may be found. The early symptoms, and indeed sometimes the later as well, suggest stone in the kidney. Colic may be present in both conditions, but pyuria is an early symptom in tuberculous disease, and a late symptom in nephrolithiasis, and later the pain and frequency in micturition is not such a prominent feature in nephrolithiasis as in tuberculosis. The duration of tuberculosis of the kidney may extend over a long period,—10 or 15 years according to Czerny-Simons.

The prognosis in renal tuberculosis is very bad when not relieved by operative measures. It would be interesting to learn the results of climatic and tuberculin treatment in a series of cases of early renal tuberculosis. With the knowledge at present available it would seem that nephrectomy is the safer and more conservative plan. As to partial nephrectomy, a careful examination of the kidneys removed has seemed to demonstrate that such an attempt must necessarily prove uncertain and unsatisfactory. The difficulty of locating the disease and removing it altogether even after complete longitudinal splitting of the kidney seems to us to be unsurmountable, and the literature contains many cases of this so-called conservative surgery of the kidney which have resulted in permanent fistulæ and subsequent nephrectomy. Bilateral disease, colic, hemorrhage, retention, or localized abscess are the conditions which Czerny and Israel consider to call for nephrotomy. These conditions demand a palliative operation. When one kidney is in a condition of pyonephrosis, but still secreting a urine of sp. gr. 1007 and 1008, while the other kidney secretes urine of the sp. gr. of 1010 or 1012, it is impossible to sacrifice any secreting tissue without imperiling the proper consistency of the blood. In such cases nephrotomy is justifiable. One must in undertaking nephrotomy under these circumstances be prepared to put up with the annoyance of a persistent sinus through which more or less purulent urine may pass.

In general, nephrectomy is the operation of choice if the disease is limited to one kidney, and is advisable not only to relieve the patient from that focus of disease, but to relieve

the good kidney from the extra work entailed by the diseased kidney. The contraindications against nephrectomy are absence or imperfect functional power of the opposite kidney, evidence of incipient disease of the other kidney as indicated by the presence of albumin, a few pus-cells with tubercle or other bacilli. Cases are reported in which after the diseased kidney has been removed the other has improved, the albumin and pus-cells in some cases disappeared altogether.

The kidneys have been removed in each instance with their capsule. In none of them was there any special difficulty; in none of them were there any adhesions to the vena cava; the peritoneum was adherent in one.

The ureter has, in each instance, been removed to the level of the brim of the pelvis or a little lower. I have adopted the plan suggested by Mayo and injected the distal end of the ureter with 20 min. of pure carbolic acid and then tied it. The recovery from operation has, in each instance, been satisfactory. There has been no operation mortality. The quantity of urine secreted is disturbed wonderfully little. The secretion during the 24 hours succeeding any operation is, as a rule, less than usual. In my cases the quantity increased day by day until the normal was attained. Hypertrophy of the remaining kidney has been noticed in some cases.

The subsequent history of these cases has been dependent very largely upon whether ulceration of the bladder was present or not at the time of operation. In my first case the patient recovered perfectly at the time—left the Hospital well, and I learned that he died some months afterwards of acute miliary tuberculosis. The second case a year after operation was still suffering from frequency of micturition, being compelled to get up 4, 5 and 6 times at night. Cystoscopic examination at this time showed that the ulcer present at the time of operation was still present, possibly not so deep, or quite so large, but not markedly changed. During the year his general health had improved, and he weighed more than ever before, but the washings were too painful to be carried out

regularly. He was put upon tuberculin and given an injection every 10 days. Since then he has steadily improved. No examination has been made of the bladder since, but in my last letter from him dated March 21, 1908, he was passing an average of 50 to 55 oz. a day. He can now go 3 hours at a time with ease, and sometimes 4 hours and is only up twice at night. This is the condition 15 months after the removal of the kidney. In another case where an ulcer was present the pain has all disappeared and the frequency of micturition is very much diminished. In still another 2 months after operation the pain and distress in urination and the frequency are not much less than they were before the kidney was removed. In this case, like the other, the passage of an instrument was so painful that the man refused to have it done. He is at present taking guaiacol, and if an improvement does not follow, I shall put him on tuberculin. These results are in marked contrast with the rapid and complete disappearance of pain and frequency after the removal of a nontuberculous pyonephrosis. In one such case all bladder symptoms had passed away completely 5 weeks after the kidney was removed.

The continuance of pain and frequency in these cases with ulcer raise the question if it would not be better to be more radical and to remove the whole of the ureter with the cornu of the bladder. This procedure, of course, adds considerably to the severity of the operation.

Tuberculosis of the genital organs or bladder may become an urgent reason for nephrectomy rather than a contraindication, the pain of the bladder and distress generally improving markedly after the kidney is removed. Early bladder disease will almost certainly recover as soon as the kidney is removed, and even extreme cystitis with ulceration around the ureteral opening may recover, particularly if the diseased cornu of the bladder itself is excised as recommended by Kümmell.

The results obtained in renal tuberculosis are improving. Schmieden collected 201 cases of nephrectomy after renal tuberculosis; of these 142 or 71 per cent. recovered, and 59 or 29 per cent. died. During the last 10 years the mortality

has not been more than 24 per cent. Israel reports 29 nephrectomies; of these 14 were primary with sound bladders; 11 recovered perfectly. Küster had 11 permanent recoveries in 17 cases of nephrectomy, Schede 16 in 22 cases and Czerny 11 in 27 cases.

In conclusion I desire to express my appreciation of Dr. R. P. Campbell's kindness and dexterity in catheterizing the ureters in the cases that I have reported.

## TRANSPERITONEAL REMOVAL OF TUMORS OF THE BLADDER.

BY CHARLES H. MAYO, M.D.,

OF ROCHESTER, MINN.

THE general application of modern methods in the examination of diseases of the bladder has been of great value in making early diagnoses of tumors of this viscus.

With the aid of the cystoscope, portions of growths are removed by snares, forceps, or by curettes, and then washed from the bladder for examination. The result of the microscopical examination when considered with the location and extent of the tumor as shown by the cystoscope enables the operator to choose a method which will offer the greatest possibility of cure to the patient.

Cystoscopic examinations should be made by means of fluid distention of the bladder, as small pedunculated papillomata will float out in the liquid when they might cling to the mucosa in air distention and thus be overlooked.

In the natural evolution of the surgery of this region, which is still far from being crystallized, many changes from former methods of treating diseases and their complications have become necessary.

When we consider Watson's statement that operations in 28.6 per cent. of benign, and 46 per cent. of carcinomatous growths of the bladder have been surgical failures, we can see the necessity for early diagnosis, and the choice of a method of approach so that radical operations may be the rule and not the exception.

The ordinary routes of attack have been the suprapubic, infrapubic, urethral, vaginal, or perineal.

The operative technic as made through the urethra, will naturally be chosen by those who become expert in the use of the cystoscope, but we believe that very few tumors will be eradicated by this route, and that it is not the best method

for the general surgeon. Watson shows that for an apparently simple procedure it is accompanied by a rather high mortality.

Of the other methods, the suprapubic is the most commonly employed. Through various abdominal incisions the bladder is opened in the Retzius space, great care being exercised to preserve the peritoneum intact. By this route papillomata have been removed with 20 per cent. mortality, carcinoma with 28 per cent., and sarcoma with 63 per cent., with early recurrence in over 20 per cent. of cases either benign or malignant, as given by Watson who has collected a large series of operations, the work of many surgeons. (ANNALS OF SURGERY, Dec., 1905.)

Considered from an operative standpoint we must recognize the fact that surgical failures are common in all kinds of tumors of the bladder above the prostate. Owing to the great tendency to recurrence as well as the possibility of a change in the character of benign growths, they must all receive radical treatment. Therefore, it is not my purpose in these remarks to devote time to the various tumors of the bladder from a pathological point of view, nor to those advanced cases which require the complete removal of the viscus. In this connection, we desire to call attention to the fact that the lymphatics of the bladder are few and inactive, which fact delays metastasis of malignant tumors, rendering them for a considerable period a local disease. Carcinoma confined to the bladder may be looked upon as curable by operation.

Clinically there occur: first, tumors with a pedicle; second, those with a broad base of attachment to the mucosa; third, those which involve the whole thickness of the bladder wall.

The latter variety may by continuity of tissue involve other organs; the prostate, ureter, urethra, or adjacent abdominal structures. Very large areas of the bladder, two-thirds or more, can be resected and the remainder will regenerate and dilate to a considerable extent, often forming a very serviceable organ, as pointed out by Harris. (ANNALS OF SURGERY, Oct., 1902.)

In an effort to develop an operation which would render all parts of the bladder accessible, the transperitoneal method seemed to be the most favorable. Watson (*ANNALS OF SURGERY*, Dec., 1905) has considered the removal of the unopened bladder through such an incision. F. Harrington (*ANNALS OF SURGERY*, 1893) has reported a case of chronic disease of the bladder treated by the transperitoneal incision. As a rule, when used at all, the method has been one developed without previous plan, of necessity or accident at the time of operation.

We have not been satisfied with the ordinary suprapubic incision in operating upon large tumors of the bladder, as, while several cases did exceedingly well, in two instances of cancer, we not only failed to cure the local condition, but unfortunately transplanted the disease to the abdominal wall and space of Retzius.

The usual result of imperfectly removed cancer is not only that relief is temporary, but the growth of the recurring tumor is usually more rapid and the condition of the patient, if anything, is worse than before the operation.

After securing the most favorable general and local conditions possible, the bladder being cleansed and emptied, an operation is made after the following method:

*Operation.*—The patient is placed in the high Trendelenberg position and a median incision made from the pubes upwards for six inches or more. The pelvis is well packed with gauze pads which hold the intestines in the upper abdomen. The abdominal incision is also protected by gauze pads. The bladder is caught by two tenaculum forceps lifted into the wound and opened by a two-inch median incision. The small amount of fluid in the bladder is absorbed with gauze and the incision is enlarged upward and downward until it is ample for the purpose. The tumors may be cut from the bladder with scissors and the denuded area burned with cautery.

Malignant growths involving the lower half of the bladder can be raised with tenaculum forceps and resected with a Pacquelin cautery. The area removed should include healthy

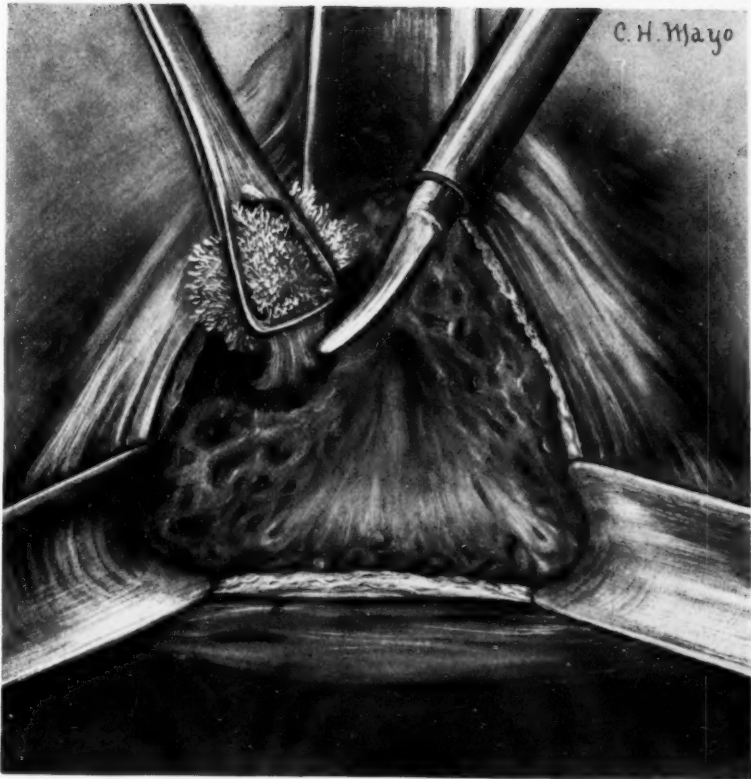
mucosa surrounding the tumor. No sutures are required to close these areas, the space being allowed to cicatrize.

When malignant growth necessitates the removal of a great part of the bladder, it is divided and removed freely, whether covered by peritoneum or not. In making the incision, one-third to one-half inch of tissue about the urethral entrance should be preserved if possible. If the bladder be involved at the ureteral opening, after the diseased portion of that viscus is removed, it is divided near the bladder and drawn into the abdomen through a perforation in the peritoneum close to the remaining half of the bladder, into which it is passed and where it is attached with catgut sutures. The peritoneum is closed over the exposed ureter in a fold by a few sutures, a method which insures rapid healing. The remaining portion of the bladder is now closed, often forming a greatly reduced but serviceable viscus.

The bladder wound, regardless of its size, is closed by a through and through continuous suture of catgut introduced in the original Connell method. This stitch is a running mattress suture and is passed through the entire thickness of the bladder wall, all loops pulling from the mucous side, and when drawn close, making a complete air-tight and water-tight continuous mattress stitch. The line of suture is now protected by a suture of silk, or preferably linen, applied as a Cushing parallel peritoneal suture, taking a square bite of the peritoneum first on one side then on the other of the line of closure, the needle being inserted parallel with the incision. This suture approximates the peritoneum and protects the primary suture just as when it is employed in gastrojejunostomy, and is used for the closure of all the bladder incisions and resections regardless of the amount removed.

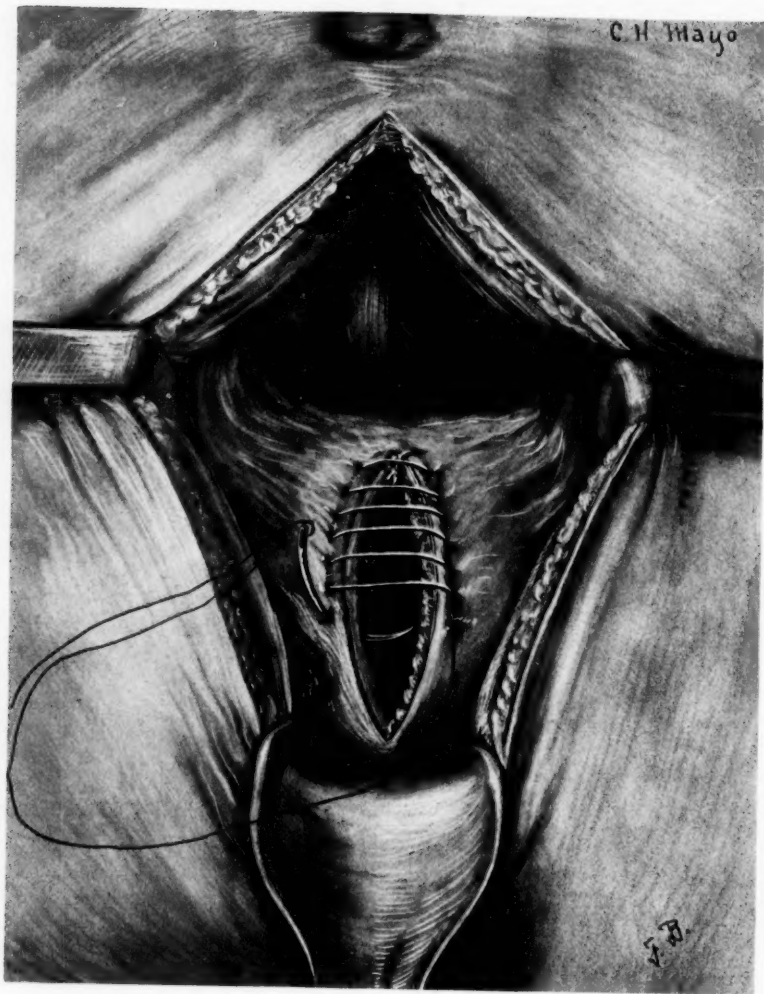
Should the bladder incision pass forward of the peritoneal fold, the closure will be the same, and is accomplished by drawing the bladder toward the abdomen and carrying the peritoneal fold to a lower level; the advantage of securing early peritoneal adhesions being developed to the fullest extent. As a rule the abdominal wound is closed without drainage, but

FIG. 1.



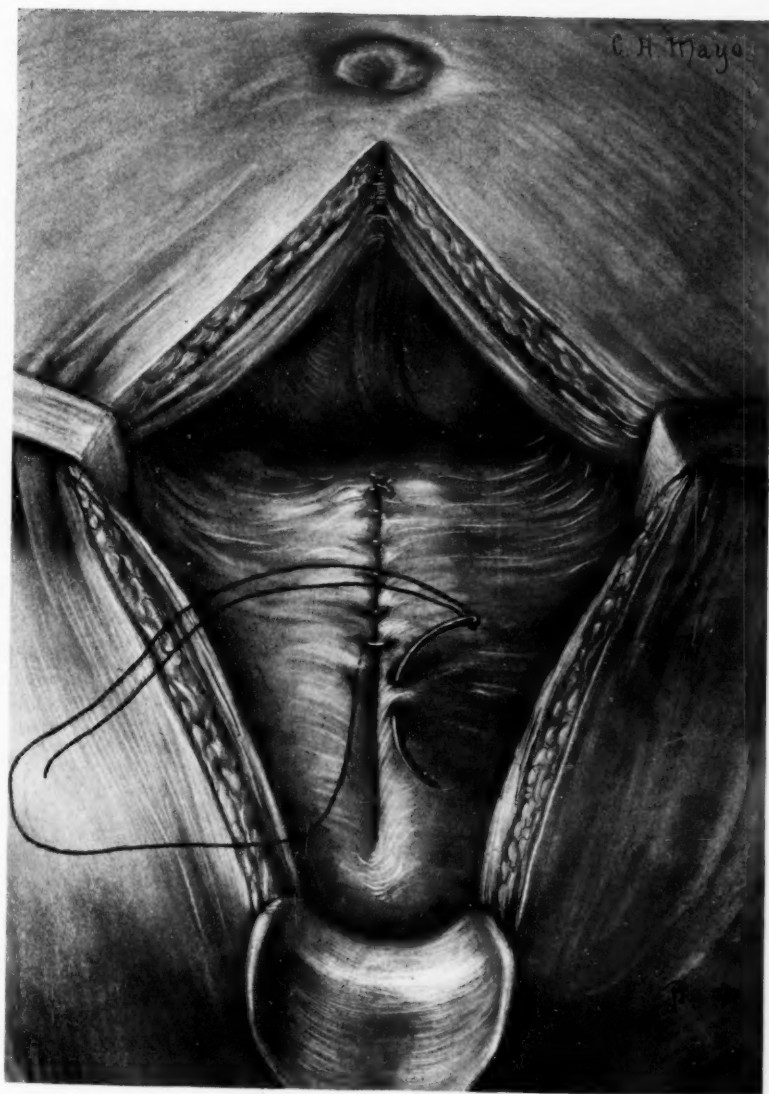
Cautery resection of papilloma of bladder

FIG. 2



Showing method of closure of bladder incision.

FIG. 3



Cushing peritoneal suture closing bladder wound.

FIG. 4.



Removal of large amount of bladder with transplantation of ureter.

should the general cavity of the peritoneum become soiled, a temporary drainage could be made through a stab-wound. The bladder is catheterized at regular intervals for the first few days following the operation, if it is necessary, but as a rule the patients void their urine at frequent intervals with little distress.

We have in five instances operated upon large papillomata of the bladder by the transperitoneal route, without mortality. Three of these tumors were carcinomatous, the others benign. A brief report of these cases is appended.

CASE I.—Male, 27. Ten years with bladder symptoms and more or less blood in the urine. Large sessile base. Carcinoma left side of bladder. Operation, 3-27-'07. Transperitoneal resection of over one-half of the bladder with transplanting of left ureter into the right half of the bladder. Bladder drained by perineal incision. Voluntary urination with control of bladder after first three or four hours. In the fourth week all drains closed.

CASE II.—Female, 39. Duration of symptoms two years. Blood in urine one year with much local pain. Cystoscope disclosed three tumors of lateral bladder wall, two small and one as large as a lemon. Operation, 5-1-'07. Transperitoneal with cautery resection of malignant papillomata. Bladder incision closed. Urine voluntary. Case well at examination after ten months.

CASE III.—Male, 50. Duration of symptoms sixteen months. Blood in urine almost constant. Papilloma size of small orange. Benign. Operation, 6-14-'07. Transperitoneal, and excision with cautery. Bladder incision closed without drainage.

CASE IV.—Male, 49.—Slight symptoms two years. Blood in urine three months. Operation, 12-7-'07. Transperitoneal removal of sessile carcinoma size of walnut near base over left lobe of prostate. Four inches bladder resected with cautery. Prostate removed through same incision. Suprapubic drain. Voluntary urination with healed drains in three weeks.

CASE V.—Male, 54. Duration of symptoms two years. Blood in urine one year. Tumor, right wall, size of walnut. Operation, 1-8-'08. Transperitoneal resection, cautery.

## AINHUM,

WITH REPORT OF A CASE.\*

BY EDMUND A. BABLER, M.D.,

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ALTHOUGH practically half a century has elapsed since Clark, in a monograph read before the Epidemiologic Society of London, called attention to this peculiar disease affecting the natives of Brazil, the characteristic feature of which is the spontaneous amputation of the affected fingers and toes, it is true that we know very little concerning ainhum.

The disease has been observed in various parts of the civilized world, although only about twenty-four cases have been observed in the United States; the present case being probably the first one reported occurring in Missouri. The literature reveals the fact that the disease is very prevalent in India. The patient is usually a negro; not more than four cases have been reported in which the patient was a Caucasian.

The etiology of ainhum remains an open question. The researches of da Silva Lima led him to regard the disease as due to injuries to the toes, while Scheube contended that ainhum was a trophoneurosis. Zambaco Pacha believed the disease to be a lesion of leprosy. Wellman has recently stated that he agrees with McFarland, who said: "The true cause of the fatty and atrophic changes in the amputated toe is not determined; it may be trophic, or it may depend on local cicatricial formation." In Wellman's opinion, the chigger may play an important role in prolonging the irritations and inflammations set up by wounds at the base of the toes. The probability of a parasitic origin has been scouted by many;

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\* From Surgical Dept., Washington University, Service of Dr. H. G. Mudd.

personally, I feel that time may prove the disease of parasitic origin. It certainly does not seem at all plausible that such a destructive process could be brought about by sharp grasses and the like, as has been long advocated by several observers. The fact that the disease has been observed in persons who have reached the meridian of life and who have worn shoes constantly since adolescence, tends, I think, to overthrow da Silva Lima's theory. Possibly we may find that uncleanness advances the development of the disease. Many of the theories that have been advanced by the early writers are quite preposterous. Dupouy has observed the occurrence of loin pains at the commencement of some of his cases, and the tendency of the disease to run in families.

Unna regards ainhum as a primary degeneration of the epidermis. It is, in Unna's opinion, a sort of ring-formed scleroderma, with callous formation of the epidermis, leading to secondary total stagnation necrosis. The horny layer is much thickened, and the papillæ are elongated and narrowed. In the papillary body, there is cellular infiltration; the papillary vessels are dilated, and the larger and deeper-lying vessels of the cutis and the hypoderm show obliterating endarteritis in different stages of development. The membrana propria is thickened. In discussing the pathology, Brayton says: "These are the progressive changes found in stagnated dermatoses. When the stratum corneum becomes thickened even in small areas, as in corns, atrophy of the underlying epidermis occurs. It is to be expected, therefore, that, with this hyperplasia of the epidermis and downgrowth of the interpapillary process, the corium should show an increase of fibrous tissue and fat; that owing to pressure there should be changes in the deeper blood-vessels and arteries; an increase of the adventitia or intima coats of the arteries so that the lumen is impaired, and finally obliterating endarteritis with slow gangrene. Eventually the constricting band approaches the bone; tumefaction of the toe occurs with stagnation of lymph and fat, gradually causing degeneration of all the constituents of the above tissue, pulp and cutis; a

condition of rarefying osteitis takes place, with final disappearance of the ungual phalanx, the partial disappearance of the second, and almost always the preservation of the third. The line of division may occur through the middle of the proximal phalanx or at the proximal interphalangeal articulation."

In our case, the patient's attention was first called to a small nodule situated on the dorsal surface of the little toe of the right foot, just at the edge of the phalangeal-metatarsal articulation. The nodule deepened and extended to the inner side of the little toe, eventually causing constriction, and the other clinical manifestations of the disease in question. The true pathology of *ainhum* will continue to remain in question until the etiology of the disease has been determined.

The clinical manifestations of *ainhum* are quite constant. The disease begins, as a rule, with a crack, fissure or nodule at the base of the toe on either the plantar or inner side. In our case, the patient's attention was first attracted to a small nodule on the dorsal surface at the base of the little toe; itching was present. The fissure deepens, gradually encircling the toe. Ulceration, bleeding and discomfort are seldom present. The distal portion of the toe becomes rounded and ball-like in appearance; it may be wider transversely than anteroposteriorly. The disease progresses very slowly; it may require ten years to completely sever the toe. Pain is seldom severe; in our case, however, the patient suffered so much at night that he could not sleep. The toe is frequently subjected to trauma.

Ulcers may appear late in the course of the disease. Palpation may be painful to the patient. When the bone has been destroyed and the toe is but loosely attached to the foot, the patient may complain severely of pain on walking. The distal portion of the toe may seem perfectly healthy; sensation may not be impaired. The medical attendant seldom sees these patients during the early course of the disease. In some instances the patient does not present himself for treatment until several of his toes have been spontaneously amputated.

PLATE I.



D. Babler's case of ainhum.

PLATE II.



Longitudinal section of toe. Note constriction.

The diagnosis is not difficult. In Raynaud's disease there are preliminary lesions such as bullæ, vesicles, edema, etc.; constitutional symptoms are present; the lesions are symmetrical. In leprosy there are other manifestations of the disease, on other regions of the body pointing to the true character of the affection; preliminary manifestations precede the destructive process. The mere fact that there is a constricting band at the base of the toe causing gradual amputation of the affected appendage should arouse suspicion.

The prognosis depends upon the degree of destruction present at the time that the patient comes for treatment. Conservative treatment has been unsatisfactory because the medical attendant does not see the patient early enough. Linear incision and antiseptic dressings will probably suffice in the early cases. Amputation is indicated when the disease has produced absorption of the bone. The necrotic mass found in some cases should be evacuated and the sac walls swabbed with carbolic acid; then cleaned with alcohol, and dressed daily.

*Report of Case.*—James A., aged 50, a colored man, presented for treatment at the Surgical Clinic of the O'Fallon Dispensary, and gave the following history: Born in Virginia, where he remained five years, then moved to Alabama, residing in the latter state for twenty-five years; moved to Tennessee, and seven years later he came to Missouri, where he has lived during the past thirteen years. The family history is negative. Patient has always enjoyed good health until nine years ago, at which time he contracted syphilis. Three years thereafter, gummata appeared on both sides of neck. About six years ago he suffered a paralysis of right side of face; appeared suddenly and has remained.

About a year ago the patient observed a small warty-like growth on inner side near the dorsal surface at the base of the little toe of the right foot. He removed it by means of his pocket knife. Within a few weeks a similar but larger growth presented at the same side, and continued to grow; within three months it had partially encircled the base of the little toe. His attention has been frequently called to the growth owing to the presence

of more or less pain in the base of the affected toe. A singular feature is the fact that the pain has been worse at night. During the past five months the distal portion of the affected toe has been gradually assuming the appearance of a ball; the hard dense growth which has extended around the circumference of the toe has gradually produced absorption of the bone; the toe may be moved as though it was but slightly adherent to the foot.

Examination shows the usual findings in *ainhum*. The reader is respectfully referred to plate I. Leprosy was readily excluded. The glands of the neck were found swollen and firm; not painful; evidence of frequent incisions. The right side of face is paralyzed. At the base of the little toe of the right foot is a semi-solid mass which presents the appearance of being a continuation of the destructive process observed in the little toe. Pressure causes pain.

Amputation of the affected, and practically destroyed toe, was advised. A few days later the toe was removed under a local anesthetic. At the base of the little toe, just internal to the phalangeal-metatarsal articulation, was found a necrotic, bloody-looking mass about as large as a small hazelnut, which led me to believe that the disease was extending to the ring toe. The parts were thoroughly swabbed with pure phenol and then with alcohol. The incised surfaces were apposed by means of sutures, and the parts dressed with moist bichloride gauze. Owing to the fact that the patient would not consent to enter the Washington University Hospital, he was compelled to return home; he placed more or less of his weight upon the right foot, thereby causing two of the sutures to cut out. At the end of ten days the parts had, however, healed. At present the patient can walk and work without discomfort.

Plate II. is a beautiful reproduction of a longitudinal section of the diseased toe. The tissues on the inner side of the constricted portion of the toe were of such firm consistency that the microtome would scarcely cut through them. This is the first longitudinal section that I have seen in any publication. I am deeply indebted to Dr. Tiedemann for his kindness in making microscopic sections, and to Dr. H. G. Mudd for permission to report the case.



FIG. 1.



Arrest of growth at lower end of radius following fracture involving the epiphyseal line.

## ARREST OF GROWTH AT THE LOWER END OF THE RADIUS AFTER SEPARATION OF ITS EPIPHYSIS.

BY ADOLPH WAECHTER, M.D.,

OF NEW YORK.

Instructor in Surgery in the New York Post-Graduate Medical School.

MASTER R. B., 11 years of age, sustained a Colles' fracture of the left hand by a fall two years ago. The hand was set and treated without any subsequent deformity or limitation of motion. As the boy grew older, his parents noticed a gradually increasing abduction of the left hand and a projection of the ulna. At the same time there was limitation of motion in some directions. They ascribed the deformity to the fact that the fracture had been improperly set. Upon examination, it was found that the hand was markedly abducted, adduction was absent, though flexion and extension were practically normal, supination and pronation limited. The radius was found to be one inch shorter than the ulna.

The X-ray examination shows two normally shaped bones, but the radius shorter than the ulna (Fig. 1). The epiphysis of the radius is united firmly with the diaphysis in the centre by bony tissue. There being no distinct demarcation as in normal bones between epiphysis and diaphysis. The probable pathology is that, the cartilaginous portion having undergone bony changes, the osteoplastic function of the epiphysis is destroyed; as the result the radius is stunted in its growth, causing deformity. These changes of permanent ossification take place about the twenty-second year, but also can be brought about by irritation of the epiphysis, as has been shown by animal experiments. The latter may be the cause in this case as the result of improper immobilization of the fragments. Fractures of the epiphyses are very frequent in young people, especially in the radius, the latter being the most frequent form of fracture of the human skeleton next to the ribs. The injury is pro-

duced by a cross-strain, the limb having been bent beyond the normal limit or direction where there is no motion.

P. Bruns collected 81 cases of epiphyseal separations, with deformity as the result of retarded growth, the most frequent site being the femur with the radius following. Most cases occurred during the years of ten to nineteen.

Among the 81 cases, there were 25 of retarded growth of the radius.

Stimson, in his large experience, only saw 2 cases.

The treatment of the above case is resection of the ulna in order to restore the functions of the wrist joint and correct the deformity.

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## STRAIN-FRACTURES OF THE KNEE.

BY SIDNEY LANGE, M.D.,

OF CINCINNATI, O.

Radiographer to Cincinnati Hospital.

THE Röntgen era has brought to light many strange and hitherto unsuspected types of fractures.

Many of these recently discovered fractures are of the indirect variety, that is, fractures due to ligamentous or muscular strain rather than to direct violence. Such fractures were formerly diagnosed and treated as "sprains." To-day the diagnosis of "sprain" is justifiable only after a Röntgen examination has shown the absence of a fracture.

The most familiar type of fracture from ligamentous strain (indirect violence) is the Colles' fracture of the wrist. It is the purpose of these few lines to call attention to a type of fracture of the knee-joint produced in an analogous manner.

A glance at the anatomical make-up of the knee-joint establishes at once the possibility and plausibility for the occurrence of indirect or ligamentous strain fractures. The knee-joint is one of the most superficial and as far as adaptation of the bony surfaces goes, one of the weakest joints in the body, for in no position are the bones in more than partial contact. Its strength lies in the number, size and arrangement of the ligaments and the fascial expansions which pass over the articulation and enable it to withstand the leverage of the two longest bones in the body.

The strongest and most important of the ligaments that unite the two component bones of the knee-joint are: (a) patellar ligament, (b) internal lateral ligament, (c) external lateral ligament, (d) posterior ligament, (e) crucial ligaments,—anterior and posterior.

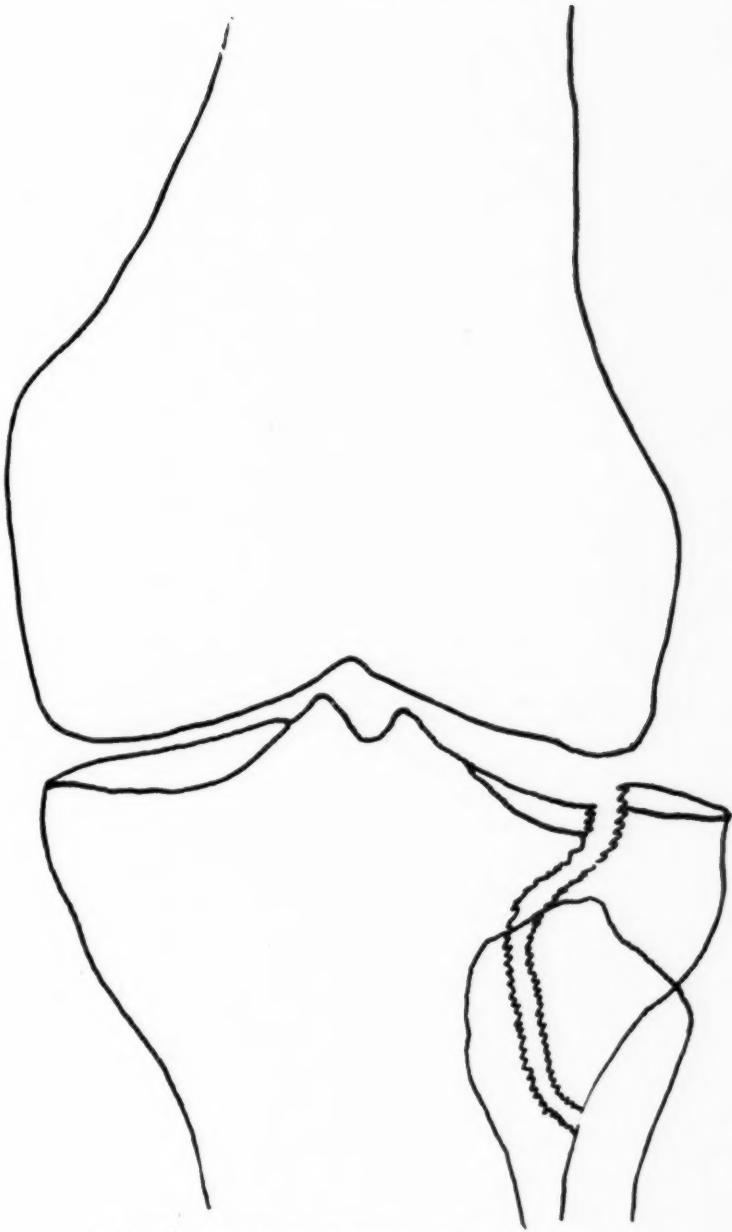
The patellar ligament is tense in flexion, relaxed in extension. Acting in conjunction with the anterior portion of the joint capsule, it limits excessive flexion. Sudden strain

in partial flexion frequently results in transverse or indirect fracture of the patella. The internal lateral ligament extends from the internal condyle of the femur to the shaft of the tibia below the inner tuberosity. It is tense during extension but relaxed during flexion. The external lateral is attached above to the external condyle of the femur. Below it divides into two portions, one of which is attached to the head of the fibula, while the smaller posterior portion joins the strong posterior ligament, to be attached to the outer tuberosity of the tibia. Like the internal, the external lateral ligament is tense during extension but relaxed in flexion. The lateral ligaments withstand the lateral strains upon the joint. They also check hyperextension and outward rotation.

The posterior ligament bounds the popliteal aspect of the joint and limits extension. The crucial ligaments play the most important part in maintaining the integrity of the knee-joint. The anterior crucial ligament is attached to the fossa in front of the spine of the tibia and to the anterior part of the ridge which separates the inner and outer tibial articular facets and is closely connected with the anterior end of the internal semilunar cartilage. The posterior crucial ligament arises from the fossa behind the tibial spine as well as from the space between the two tubercles which go to make up the tibial spine. It receives fibres from the posterior ligament and from the external semilunar cartilage. The crucial ligaments are inserted above to the mesial aspects of the inner and outer femoral condyles. They are more or less tense in all positions of the knee-joint, with the possible exception of flexion. They limit extension and (the anterior crucial) inward rotation. In conjunction with the lateral ligaments they prevent forward and backward sliding motions. Their function in flexion is somewhat unsettled. Treves insists that they become tense in flexion and thus limit over-flexion.

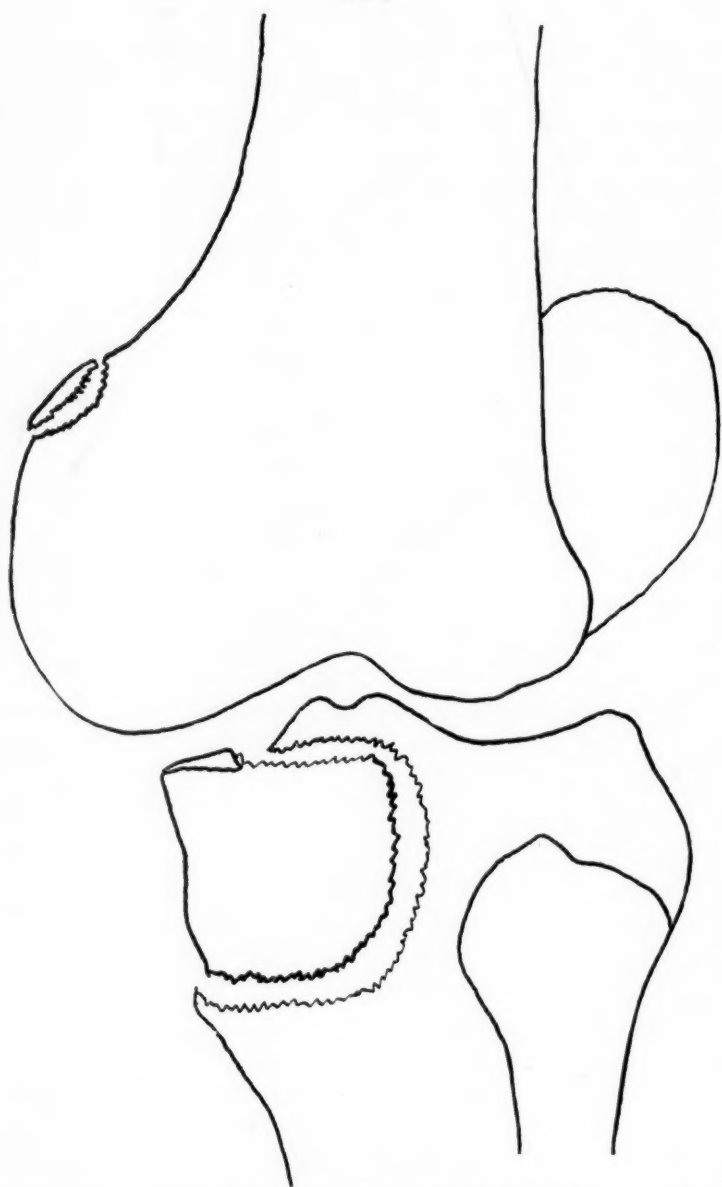
In studying the effects of strain upon the knee-joint in various directions, we may dismiss at once the flexion strain against the resistance of the patellar ligament and its subtended muscles, for we are well acquainted with the transverse

FIG. 1.



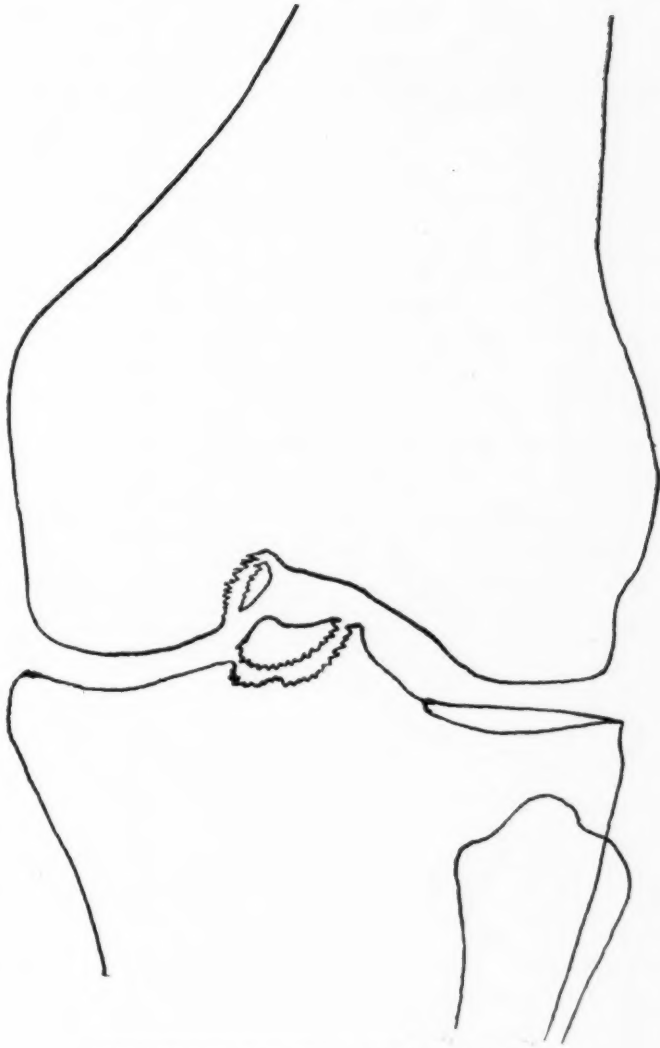
Avulsion of external tuberosity of tibia. Outline from a skiagraph.

FIG. 2



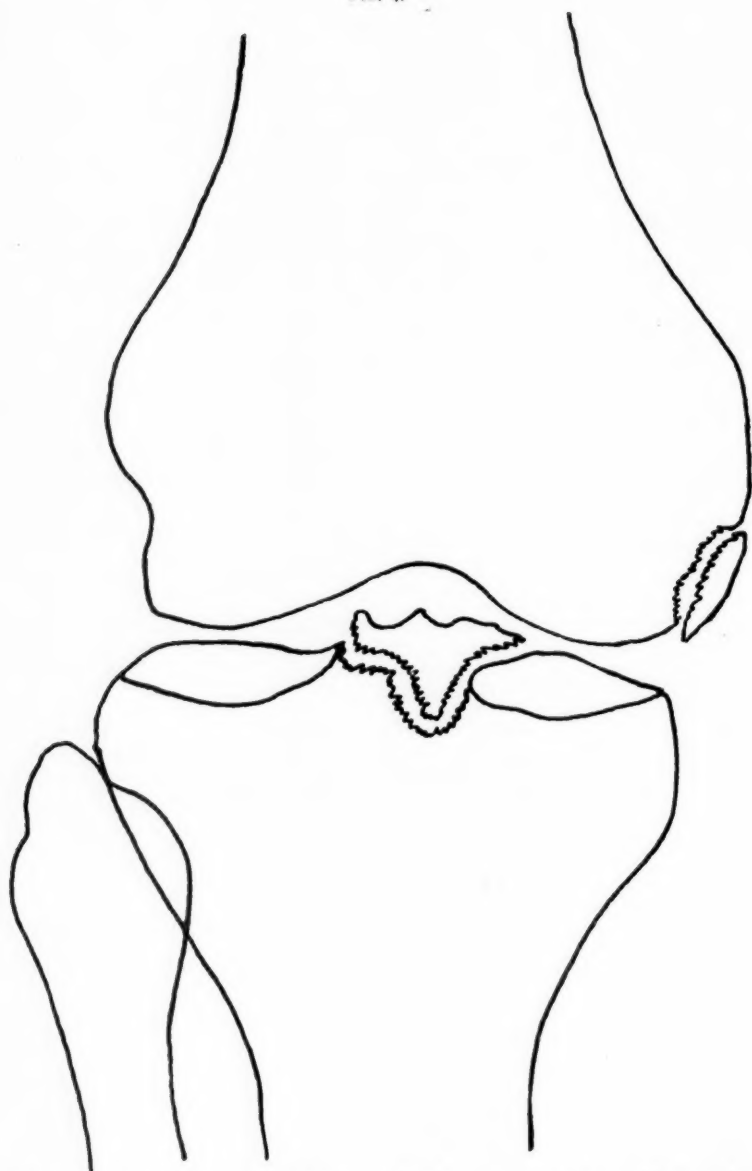
Avulsion of fragment from the internal tuberosity of head of tibia with tearing off of small scale from internal tuberosity of the femur. Outline from a skiagraph.

FIG. 3



Crucial ligament fractures. Outline from a skiagraph.

FIG. 4.



Crucial ligament fracture ; with tearing away of scale at insertion of internal ligament into femur. Outline from a skiagraph.

patella fractures which most commonly follow such violence.

We have then to consider:

(a) Strain in the direction of hyperextension against the crucials, the posterior and the lateral ligaments;

(b) Strain exerted laterally against the internal or external lateral ligaments, the knee being in extended position, which puts these ligaments on the stretch;

(c) Strain in a rotatory direction, either in the direction of outward rotation, which is normally limited by the lateral ligaments, or in the direction of inward rotation, which is normally limited by the anterior crucial ligament.

It should be understood that the above scheme is arranged simply for the purpose of discussion and that in any given case the strain will be exerted in several directions simultaneously.

The following four cases served to call the writer's attention to the frequency of strain-fractures about the knee.

CASE I (from the service of Dr. J. C. Oliver).—Mr. C. W. K. While attempting to board a moving street car, the patient missed the car step, "twisted his knee," and fell to the ground. He at once arose, experiencing only slight pain in his knee (right) and walked six squares when the pain became so intense that he was compelled to sit down in a neighboring drug store, whence he was removed to the Cincinnati Hospital. *Examination of the knee showed no evidence of direct trauma to the soft parts.* A skiagraph (sketch 1) showed a tearing off of the *external* tuberosity of the tibia, the line of fracture running into the knee-joint.

CASE II (from the service of Dr. J. C. Oliver).—Mr. C L. Patient was injured in a street car accident. The left femur was fractured about two inches above the knee. *The right knee showed no evidence of direct trauma* and exhibited no positive signs of fracture of its component bones, but the severe pain on manipulating the joint suggested the need for a Röntgen examination. The skiagram revealed a tearing off of the *internal* tuberosity of the tibia as well as a small fragment off the internal condyle of the femur, evidently a strain-fracture (sketch 2).

CASE III (from the service of Dr. C. E. Caldwell).—Mr. McD. while wrestling accidentally twisted his left knee and fell

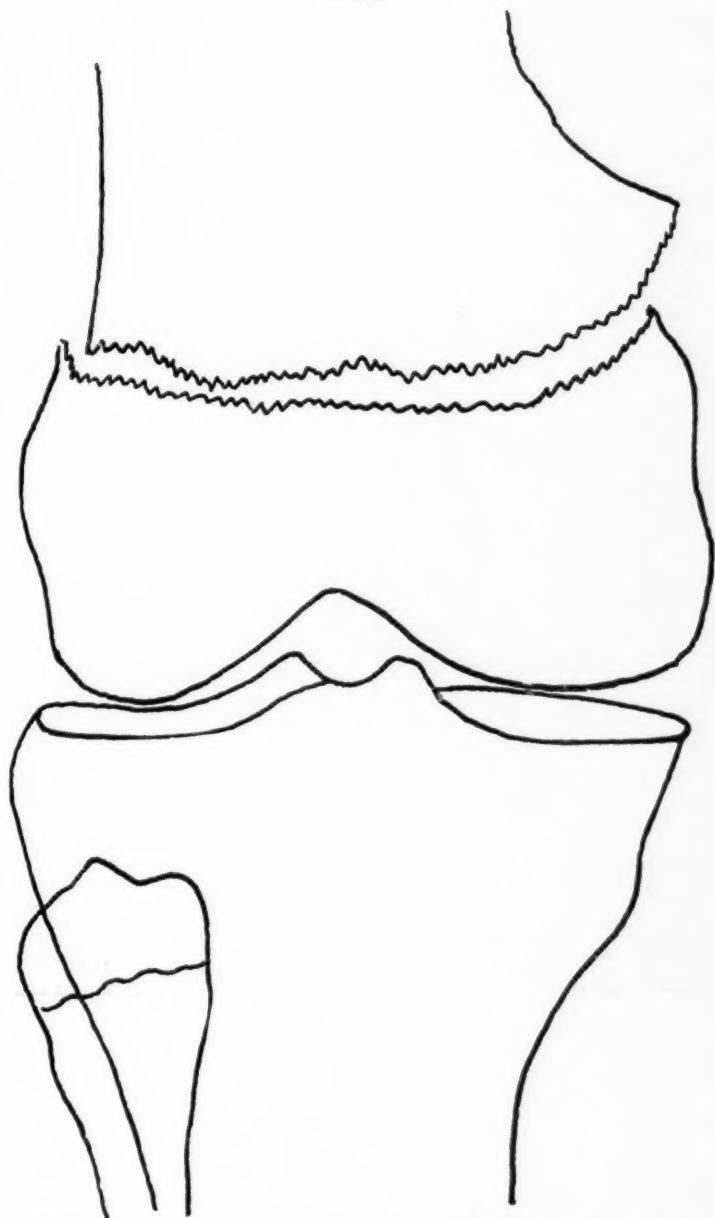
to the floor. He experienced great pain in the knee-joint but was able to walk to the hospital. Physical examination revealed a somewhat enlarged thickened joint but gave no positive evidence of fracture. A skiagram revealed a tearing off of the tibial spines (sketch 3).

CASE IV (from the service of Dr. Jos. Ransohoff).—Mr. J. D. while attempting to alight from a moving street car, twisted his left knee and was thrown violently to the ground. He was unable to arise, owing to the great pain in his knee. Physical examination showed *no bruising of the soft parts* nor evidence of fracture. A skiagram showed a tearing off of the internal condyle of the femur and an avulsion of the tibial spine (sketch 4).

In the above-cited four cases of fracture about the knee we have a history of a sudden and severe strain to the knee-joint with, upon physical examination, no evidence or bruising of the soft parts nor any of the usual signs of fracture. In Case I we may assume a lateral strain upon the knee from within outward, putting the *external* lateral ligament on the stretch, and then causing a tearing off of its tibial attachment (the *external* tuberosity of the tibia). In Case II we may assume strain in the opposite direction, which was exerted chiefly upon the *internal* lateral ligament, resulting in a tearing off of its tibial attachment (the *internal* tuberosity of the tibia) and also loosening a small fragment at the site of its femoral attachment (the internal condyle of the femur). In Case III the strain was borne chiefly by the crucial ligaments, resulting in an avulsion of the tibial spines at their base. In Case IV the strain was apparently felt first by the internal lateral ligament, which resulted in a tearing off of its femoral attachment (the internal condyle of the femur). This giving way of the internal lateral ligament apparently put the crucial ligaments on the stretch as evidenced by the avulsion of their tibial attachment (the tibial spine).

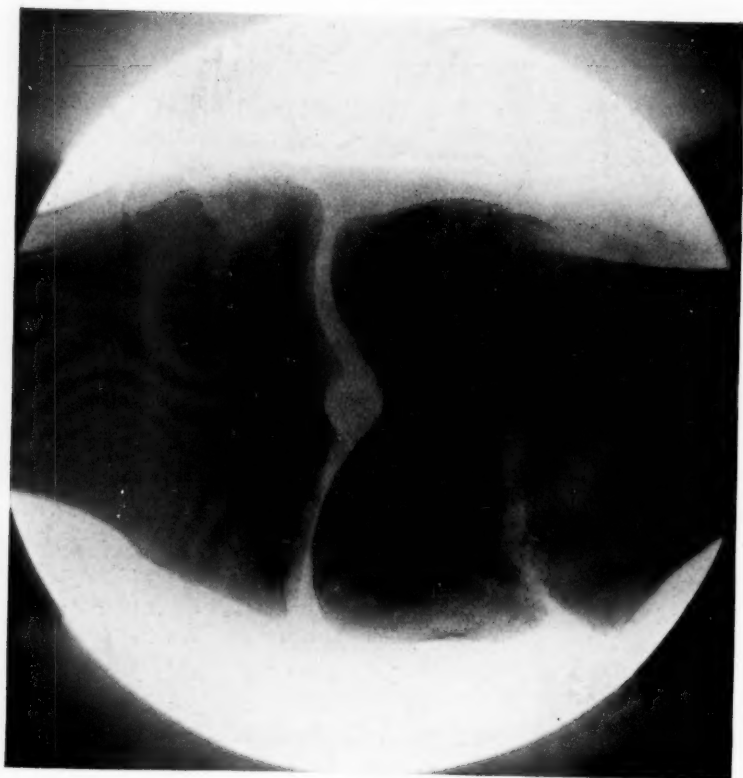
In studying the effect of knee strain by experimenting upon the cadaver, still another type of fracture by indirect trauma was brought to light. Figure 5, sketch 5, shows the result of lateral and postero-anterior strain upon the knee of

FIG. 5.



Epiphyseal separation at lower end of femur. Outline from a skiagraph (Fig. 6).

FIG. 6.



Skiagraph of epiphyseal avulsion at lower end of femur.

the cadaver of a young adult. It consists in a complete epiphyseal separation of the lower end of the femur. It was produced by placing the cadaver in a ventrolateral position and bending the knee over the edge of the table.

It is more than probable that such a fracture may be produced in the living in an analogous manner.

The close relation between the crucial ligaments and semilunar cartilages (anterior crucial with internal semilunar and posterior crucial with external semilunar) indicates that strains upon the crucial ligaments will be felt by the semilunar cartilages and that dislocations of the semilunar cartilages may be accompanied by strain-fractures of the above-described type and vice versa.

Routine Röntgen examination of injured knee-joints will undoubtedly show strain-fractures of the component bones to be relatively frequent. The well-executed skiagram will render possible an accurate diagnosis of conditions that are too often vaguely termed "internal derangements of the knee-joint."

TRANSACTIONS  
OF THE  
NEW YORK SURGICAL SOCIETY.

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*(Stated Meeting, February 26, 1908.)*

The President, DR. JOSEPH A. BLAKE, in the Chair.

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TRAUMATIC EPIDURAL AND INTRACEREBRAL  
HEMORRHAGE.

DR. BERN B. GALLAUDET presented a young man who was admitted to Bellevue Hospital, November 27, 1907, with the history of having received a blow on the left side of the head the day before. He was not continuously unconscious, but almost immediately became aphasic. On admission to the hospital, about fourteen hours after having received his injury, he was aphasic and showed right-sided paralysis of the arm and face. An operation revealed a stellate fracture of the skull, with extra- and subdural hemorrhage, as well as hemorrhage into the brain cortex over the area indicated by the symptoms. The patient left the hospital a month after the operation, showing satisfactory improvement. There was still some facial paralysis, but he was now able to move the arm. His aphasia had also gradually disappeared, although he still hesitated in his speech.

OSTEOPLASTIC CLOSURE OF SKULL DEFECT.

DR. CLARENCE A. McWILLIAMS presented a woman, 26 years of age, upon whom he had performed an osteoplastic operation for the covering of a skull-defect following a compound depressed fracture of the vault of the cranium, complicated by laceration and abscess of the brain. The patient was brought to the Presbyterian Hospital by the ambulance on May 6, 1907, and was admitted to the service of Dr. McCosh, to whom Dr. McWilliams was indebted for the privilege of operating upon the case. She had been struck by a trolley-car, and when found was unconscious, pulseless and bleeding from the nose and from a

compound comminuted depressed fracture of the left frontal region of the skull. From this large wound, cerebral tissue was oozing freely. The anterior extremity of the scalp wound was situated at the beginning of the hair-line in the left frontal region, and ran backwards about four inches, and from it several fragments of bone protruded. The patient was in coma; the pupils were equal and reacted to light; there was no subconjunctival hemorrhage; a partial paralysis of the right arm and leg could be made out; there was bleeding from both nostrils, but none from the ears, and there were some ecchymotic spots under the skin of the left mastoid bone. The knee-jerk was absent on the right side, but present on the left. Babinski reflex present on both sides. Death was considered certain in a short time. However, under energetic stimulation, the pulse became just perceptible in six hours. The wound was cleaned and several fragments of bone removed. Her condition remained so serious that it was 36 hours before it was deemed advisable to transfer her from the accident room to the hospital ward. The patient remained unconscious for about two weeks, during which time she was fed by gavage. The urine and feces were passed involuntarily; the catheter being passed several times indicated that the bladder remained empty. The wound suppurated, and on enlarging it a collection of two ounces of pus was evacuated from a cavity in the cerebrum. There was a marked tendency for the brain to protrude, with sloughing off of fragments of it. Three and a half weeks later, the patient was just able to say a few intelligent words, but she was stupid and somnolent. The right arm and leg were still partially paralyzed. Urine and feces are still passed involuntarily. A fragment of bone, one by one and a half inches long, was removed from the wound, and a second larger fragment was felt to be movable but somewhat attached. The wound was granulating, and there was a granulating area of exposed brain tissue,  $1\frac{1}{2}$  in. wide and 4 in. long, spindle-shaped, with the long axis anteroposterior. Paralysis of the arm and leg remained the same.

On June 30, 55 days after the accident, the patient had been up and about for ten days. The function in the right arm and leg was returning. There was no facial paralysis. The bladder and rectum were functioning normally. Cerebration was very poor, the patient seeming unable to say connected sentences,

although there was no motor paralysis of speech. Her memory was badly impaired.

On July 9th, 64 days after the accident, she left the hospital to return for regular dressings for the granulating skull cavity. She had almost entirely recovered from the paralysis of the arm and leg.

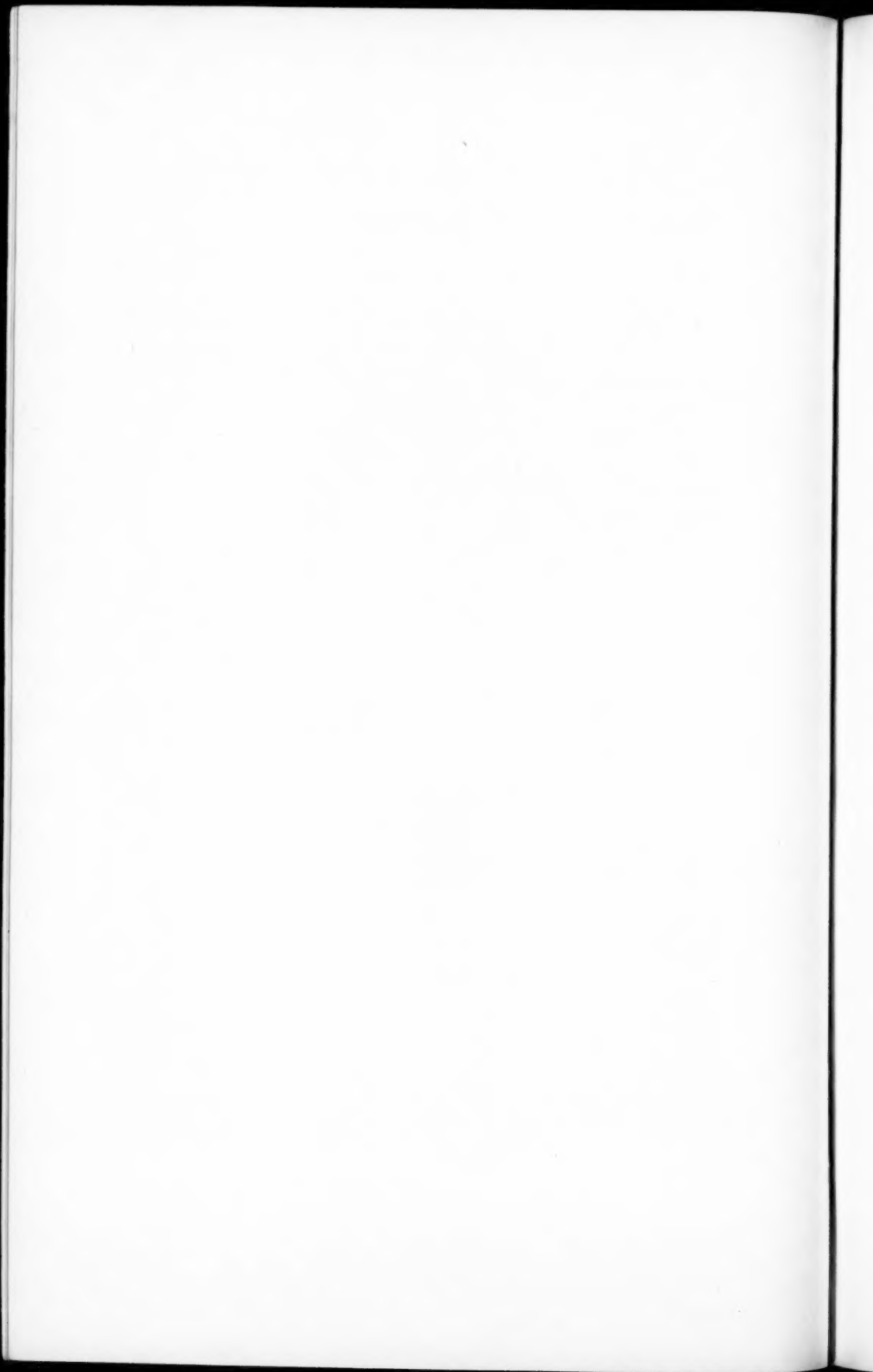
Four months later, the process of granulation of the wound seemed almost at a standstill. The epidermis had crept in at the edges, so that the bones were covered over and the skin was attached to the cerebrum. At the bottom of the cavity was the pulsating cerebrum which was covered by granulating tissue, and which, by reason of its loss of tissue, was depressed about one half inch from the internal surface of the bones. She was re-admitted on November 4, 1907, to have the defect closed. This was deemed possible only by turning in a flap from the sides, since it was thought that if any foreign substance was placed in the wound, it would have to be removed later because of the granulating surface of the cerebrum. It seemed certain that the dura over the cerebral wound had sloughed away. The operation was conducted as follows: A piece of rubber tissue was placed over the defect, and a pattern cut out of it of the cavity, but one half inch larger than the same all around. This pattern was then laid on the skin to the right of the edge of the cavity, and an incision was made along the edge of the rubber tissue down to the bone through the periosteum, but leaving a pedicle of about an inch posteriorly. A chisel was then inserted along the incision line, the object being to chisel out a piece of the external table corresponding to the flap, and to raise it attached to the periosteum and skin. It was found that it was impossible to raise the bone in one piece, but that it broke in several places. However, the flap was finally turned in, so that the defect was entirely covered, there being on its under surface, several pieces of thin bone. The cicatricial edges of the defect were cut away, and the edges of the reflected flap were sutured to the edges of the skin of the defect, a small place being left posteriorly for drainage. The bare bone left by the removal of the flap was covered by some Thiersch skin grafts, taken from the thigh of the patient.

The wound healed very kindly, and the result is shown in the accompanying photograph (Fig. 1). There is some sinking in

FIG. 1.



Showing result after operation for osteoplastic closure of skull-defect.



of the flap, due to the loss of cerebrum beneath. It feels quite firm, indicating that there is a bony foundation to the flap.

#### FRACTURED SKULL, WITH EXTRADURAL HEMORRHAGE.

DR. JOSEPH A. BLAKE presented a female infant, three weeks old, colored, who was brought to Roosevelt Hospital three days after birth (forceps delivery) with a history of convulsions since that time, and a right-sided facial paralysis. The latter was complete, involving the entire distribution of the nerve, and probably peripheral, while the convulsions were apparently due to some injury of the brain or its membranes. During one of the convulsions observed at the hospital the mouth was drawn to the left, the right eye was tightly closed, and the right hand and arm were drawn up. Subsequently, she had three convulsions that night and several the next day, all involving the same region.

There was a hæmatoma of considerable size over the left temporal region, and upon exposing the skull, a curved linear fracture was discovered, corresponding closely in situation to the squamous suture. Upon elevating the bone, several small clots were found underneath; these were removed, and the bone flap replaced. The child's general condition improved markedly after the operation, and she has had no definite convulsion since. There was at first an occasional slight twitching of the hand, but this disappeared after three or four days. There were still some evidences of her facial palsy.

#### CEREBRAL INJURY DUE TO A DEPRESSED FRACTURE OF THE SKULL IN AN INFANT.

DR. GEORGE E. BREWER presented a girl nine months old, who was admitted to the Roosevelt Hospital on January 2, 1908. Six days before admission she had sustained a severe injury to the left side of the skull by a fall from her mother's arms. When picked up the child was apparently dead, and it was some time before the respiratory movements were reëstablished. Later it was noticed that the child did not move the right side of the body. She was kept at home under medical observation for six days. At the end of that time she was brought to the Roosevelt Hospital.

On admission the temperature was  $101.5^{\circ}$ ; pulse 128. The child was apparently conscious, took and retained nourishment

in abundance, and was not particularly restless. The right arm and leg were scarcely moved at all, while the left extremities appeared normal. There was a conjugate deviation of the eyes to the right, there was slight left facial palsy, the pupils were apparently equal and reaction normal. Examination of the head revealed an oblong swelling extending transversely across the mid-parietal region. This swelling was moderately elastic, and at the upper edge the bone could be felt distinctly depressed. On the advice of a neurologist the case was kept under observation for ten days, in the hope that the symptoms might subside without operation. On January 11th however, the condition being practically the same, the child was prepared for operation and a curved incision made over the left parietal region including the swollen area of the scalp. On lifting the omega-shaped flap of skin and soft tissues, there appeared to be a longitudinal fissure extending over a distance of nearly three inches across the centre of the parietal bone, which was joined near its anterior extremity by one extending upward toward the sagittal suture. The skull in the region of the longitudinal fissure was markedly depressed, and along the line of fracture there appeared a sausage-shaped mass of necrotic tissue about two and a half inches in length, and about three quarters of an inch in diameter. This mass appeared to be made up of dura and cerebral cortex, which had evidently been caught up by the depressed fragments at the moment of their greatest depression, and had been brought outside the skull by the spontaneous movement of the fragments towards their normal position. The upper fragment of bone which was most displaced, and which apparently caused marked cortical pressure was removed by bone forceps, also the depressed portion of the lower fragment. This exposed quite an area of the cortex, which was roughened and covered with a fibrinous exudate so that the shape of the convolutions could not be seen. The external necrotic mass was connected with the cerebral cortex by a flattened pedicle, which had occupied the fissure between the two depressed fragments. This was entirely removed, and as the condition of the patient was quite critical the operation was hastily terminated by replacing the cutaneous flap, and fastening it with two or three silkworm gut sutures. While this was being done, the child passed into a condition of complete collapse, pulse imperceptible, respirations entirely suspended. She was placed

in an inverted position, artificial respiration was undertaken, and the bowel partly filled with a hot salt solution. As a result of these stimulating measures, the child slowly rallied. An aseptic dressing was applied to the wound, and the child returned to the ward with a pulse of 160. Following the operation there was a sharp rise of temperature to  $102^{\circ}$  which however soon fell to the normal. The convalescence was uninterrupted, and she was discharged from the hospital ten days from the day of her operation. It is now twenty-five days since her discharge from the hospital. She appears in perfect health, and there is no apparent limitation of the movements of the arm and leg, the eyes are normal, and there is no evidence of facial palsy. The presence of a slight left-sided facial palsy, and the drawing of the eyes toward the right, would suggest some right-sided lesion. As it is quite evident that the depression of the fragments which occurred at the time of the injury must have been very great to have caught up such a large mass of cerebral tissue, it is easy to understand how such an injury might, by forcing the cranial contents violently toward the right, have caused some cortical lesion over the right motor area.

#### THE QUESTION OF OPERATION FOR NON-PENETRATING INTRACRANIAL TRAUMA.

DR. JOHN A. HARTWELL read a paper with the above title, for which see page 25.

DR. KILIANI said that in 1891 he reported a case of subdural hæmatoma with a free interval of 21 days. The man had received a blow on the head from which he apparently suffered no ill effects, but 21 days later his right arm became paralyzed. He was operated on on the twenty-fourth day after the receipt of the injury, and a subdural hæmatoma was found in the left motor area. Recovery was uneventful.

DR. McCOSH said there was one point upon which sufficient stress had perhaps not been laid, and that was, the danger of future epilepsy after comparatively slight injuries to the head, and in cases where the early symptoms were perhaps trifling or even entirely absent. He always instructed his house surgeon, in dealing with cases of head injury in which there was any hæmatoma or any focal symptoms, to lay open the scalp and carefully examine the skull for evidence of fracture. The speaker

said he had learned from experience never to give a fatal prognosis in a case of fracture of the skull; he considered it a very unwise thing to do. The case shown by Dr. McWilliams, when it entered the hospital, was apparently a hopeless one, and yet the woman had recovered.

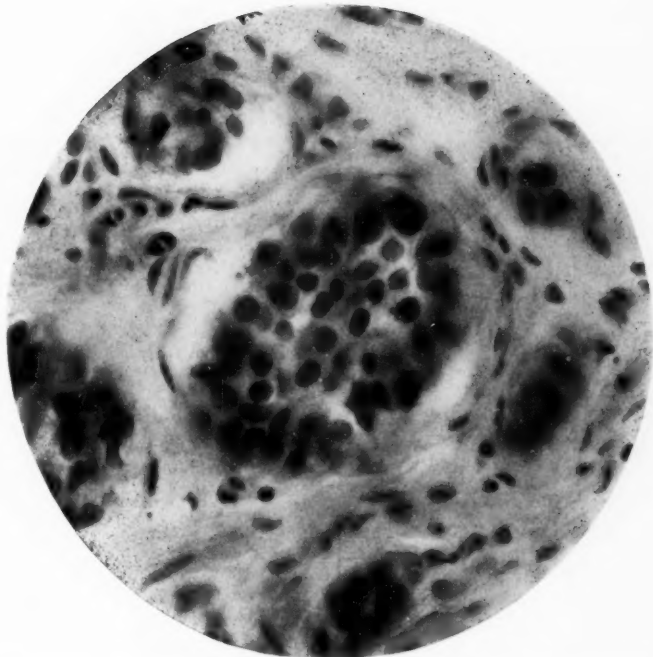
PRIMARY CANCER OF THE APPENDIX: NO RECURRENCE  
AFTER NINE YEARS.

DR. ANDREW J. McCOSH presented a man, 34 years old, who was admitted to the Presbyterian Hospital on April 7, 1897. He stated that his difficulty began in the previous August, when he had sudden cramp-like pains in the right lower abdomen, accompanied by vomiting. These persisted about two weeks. During the following month he had a similar attack, lasting three weeks. He then remained well until the following March, when he was seized with sudden tenderness and pain in the right iliac fossa, with abdominal distention and vomiting. He was just recovering from this attack on his admission to the hospital, and an examination showed rigidity and tenderness in the right iliac fossa.

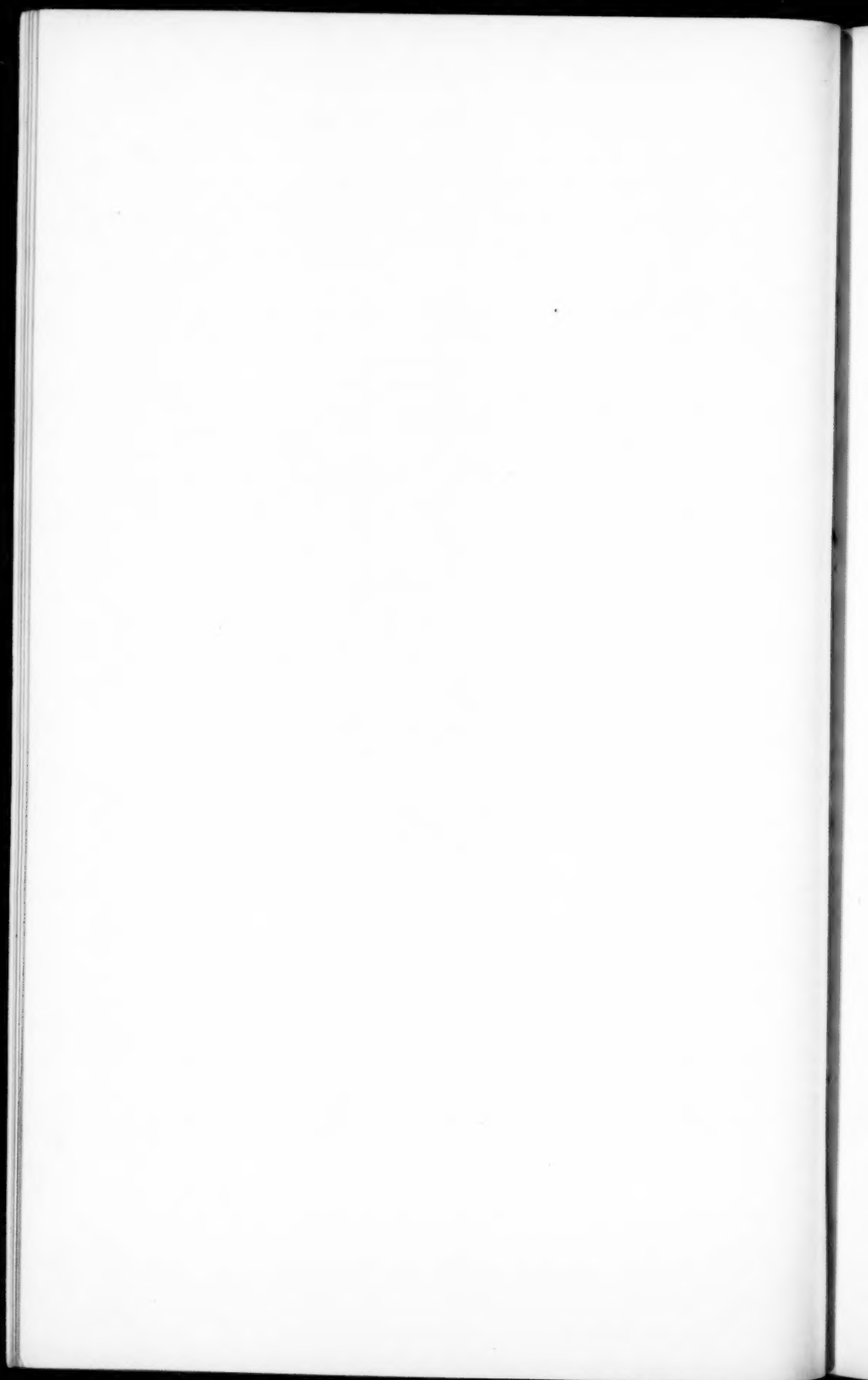
An indefinite mass was felt in the cæcal region. Upon operation no fluid was found in the abdomen. Just to the outer side of the right sacro-iliac there was a semi-elastic non-pulsating mass three and a half inches in diameter and an inch and a half in depth. It involved the cæcum and appendix synchronously, and extended apparently behind the posterior peritoneum. It was somewhat boggy to the touch, and an aspirating needle was introduced into it with negative results. It was regarded as a malignant tumor, involving the cæcum, appendix and peritoneum. Its removal was deemed impossible, and the wound was closed with drainage. The patient made a good operative recovery and left the hospital in good condition.

He was re-admitted on January 4, 1899, twenty months after his first operation, with the following history: For the past eight months he had had attacks of cramp-like pain in the region of the old scar. These attacks had latterly become more frequent. He had lost no flesh nor strength; there was no history of jaundice and the bowels were regular. There was a ventral hernia in the old appendix scar. Upon palpating through this scar there was felt at the usual site of the appendix a hard mass, about the

FIG. 2.



Spheroidal-celled cancer of the appendix. The muscular coats are arranged in a circular and longitudinal group, and scattered irregularly between the muscle bundles are alveoli filled with irregular ovoid or polyhedral cells with large nuclei. In other portions there is a diffuse infiltration of the muscle tissue with similar cells. There are no mitoses visible in the cells.



size of a hen's egg. Upon operation, which was done on January 10, 1899, the intestines and omentum were found to be firmly matted together. Several large hard masses were felt in the posterior part of the abdomen, which proved to be enlarged retroperitoneal glands. The glands throughout the mesentery were also enlarged and hard. The appendix was separated from the adherent intestines with much difficulty. It was short and much thickened, and resembling an old chronic appendicitis. It was removed, and the wound closed with drainage.

A pathological examination of the specimen (Fig. 2), made by Dr. John S. Thatcher, showed typical adenocancer in some of the sections. A subsequent pathological examination was made by Dr. F. C. Wood, who pronounced it a spheroidal-celled carcinoma of the appendix vermiformis. Examination of the enlarged glands at the time of the operation showed them to be uninvolved by cancer. The patient now 9 years after the removal of his appendix enjoys perfect health, and there is no evidences of a recurrence. He has gained weight. There is a hernia at the site of the scar which gives him no annoyance. Dr. McCosh had operated on another case of cancer of the appendix. At the end of a year he was well, but since that time search for him has been in vain.

DR. OTTO G. T. KILIANI said he had seen two cases of primary carcinoma of the appendix. One was operated on five years ago; and when the speaker lost sight of him, about eight months ago, there were no signs of a recurrence, and the patient was in good health. The other was operated on about a year ago and was lost sight of. Both were adenocarcinomata.

#### PERFORATED ULCER OF THE DUODENUM.

DR. JOS. A. BLAKE presented a man, 43 years old, a horse-shoer, who was admitted to Roosevelt Hospital on December 13, 1907.

For one year he had had gnawing pain in, above, and to the right of the umbilicus, occurring in attacks which had gradually increased in length and severity so that for four weeks before admission he had given up his work. The pain was somewhat relieved by the ingestion of food and by vomiting. He had never vomited blood, but for two months the stools had been tarry. He had lost weight.

The abdomen was somewhat scaphoid, symmetrical. There was a sensitive point above and to the right of the umbilicus. No mass was made out. Gastric analysis showed hyperchlorhydria.

At operation a mass was found between the first portion of the duodenum and the pancreas. The pylorus was not stenosed but was fixed to the mass on its deep surface. The mass did not appear to be carcinomatous, but on account of the lack of stenosis, the efficacy of a simple gastro-enterostomy seemed questionable and a pylorectomy was decided upon. This accordingly was done, but with the greatest difficulty for it was found that the lesion was a large ulcer which had perforated the first portion of the duodenum into the head of the pancreas. In separating the structures, the entire pancreatic wall of the first portion of the duodenum seemed to be deficient. Closure of the duodenal stump was well-nigh impossible but was finally accomplished by turning its lateral wall over and sewing it to the pancreas. So much time had been occupied by the operation that a button anastomosis was made. After the operation, there was considerable hemorrhage into the stomach owing to faulty hæmostasis, but with this exception recovery was smooth. A large drain of gauze and rubber dam was inserted to the duodenal stump and left in situ for ten days, leaving a large sinus which closed slowly. There was not, however, any leakage from the duodenum. He is now back at work without gastric symptoms and is gaining flesh.

PERFORATED GASTRIC ULCER: DIFFUSE PERITONITIS:  
PERITONEAL LAVAGE: CLOSURE WITHOUT DRAINAGE.

DR. JOS. A. BLAKE presented a man, 45 years old, a publisher, who was admitted to the Roosevelt Hospital on February 12, 1908. Four hours before admission he had had a severe attack of pain while hanging up his coat. He immediately collapsed and suffered agony until relieved by two hypodermics of  $\frac{1}{4}$  gr. each of morphine. He had suffered from indigestion for five or six years.

On admission his abdomen was scaphoid and extremely rigid. There was diffuse tenderness most marked on the right side. Liver dulness was absent.

Operation six hours after the perforation revealed an opening 4 millimetres in diameter situated immediately at the pylorus

on its anterior surface. The gastric contents were escaping. The peritoneum everywhere in sight was injected and appeared swollen. The abdomen contained considerable quantity of gum-mous mucoid fluid.

The perforation was partially closed by a purse-string suture, but the suture could not be made secure until the duodenum had been folded over on the stomach, thus almost completely closing the already stenotic pylorus. The peritoneal cavity was then thoroughly washed out with a two-way irrigator, dirty fluid being returned from all parts of the abdomen. A posterior no loop gastro-enterostomy was then done by suture and the abdominal wound completely closed without drainage. Time of operation was fifty minutes.

The pulse came down a few beats as a result of the operation and he was returned to bed in good condition. His highest temperature,  $101^{\circ}$ , was reached on the third day and became normal on the fifth day.

Albumin water was given on the day after operation and on the third day he was given whole milk that had been coagulated with rennet, and the curd then beaten with an egg beater and pressed through cheese-cloth, there then being no possibility of large curds forming in the stomach. This form of milk, devised by Dr. Walton Martin, has been used with great success in several postoperative stomach cases and is far more palatable than peptonized milk.

#### PERFORATING GASTRIC ULCER.

DR. JOS. A. BLAKE reported this case, and showed the specimen. The patient was a housemaid, 21 years old, who was admitted to the Roosevelt Hospital on December 6, 1907. For six months she had pain rather characteristic of gastric ulcer, accompanied by vomiting. The vomitus had contained food and mucus, but not blood. She had lost between ten and fifteen pounds. Five weeks before admission she had noticed a small lump situated in the middle line of the abdomen above the umbilicus. This had grown steadily in size and had become tender. Upon examination, a hard tender mass, the size of a quarter, was found at the linea alba, one and one-half inches above the umbilicus. It was fixed, and apparently was partly superficial to and partly beneath the recti muscles.

The stomach analysis showed an increase in free hydrochloric acid.

At operation, the mass was found to consist of a dense zone of reparative tissue thrown about a perforating gastric ulcer. The ulcer, one centimetre in diameter, had perforated not only the wall of the stomach, but the linea alba, its floor consisting of the new connective tissue felt beneath the skin. The ulcer thus formed a sort of tube two centimetres in depth, surrounded by a dense wall of fibrous tissue, one centimetre in thickness. There were no adhesions beyond this wall. The ulcer was situated in the anterior wall of the stomach, close to the lesser curvature, five centimetres from the pylorus. It was excised, the lines of excision crossing the lesser curvature and extending into the posterior surface of the stomach. After excision, the opening in the stomach was closed by an inner continuous suture of chromicized gut and a Cushing suture of silk. No further treatment was carried out, as the pylorus was open. Recovery has been uneventful and free from symptoms of ulcer.

DR. HOTCHKISS enquired whether Dr. Blake had noticed in these cases of operation upon the stomach, a tendency to non-union in the abdominal wound. He had had this experience recently in a case of perforated gastric ulcer in a very emaciated man where at the end of about a week the abdominal wound had burst open and this apparently was more from lack of reparative power than infection.

DR. McCOSH said he could recall two or three instances where after stomach operations on semi-moribund patients, the sutures failed to hold, simply pulling through the tissues, and this without the slightest evidence of infection of the wound. When at the end of 10 or 12 days the silk sutures were removed there was an almost complete lack of repair and the wound edges fell apart. As well as he could remember operation in these cases had been done for cancer.

DR. BLAKE thought the point brought up by Dr. Hotchkiss was a very important one. He had noticed this absence of reparative power particularly in cancer of the stomach, since starvation was associated with cachexia. Under such conditions, it was now his practice to use a non-absorbable suture material.

DR. KILIANI said that in his cases of cancer of the stomach he employed very heavy suture through and through material of

silk; for closing the abdominal wound he had found that other sutures were liable to tear out.

## TYPHOID PERFORATION OF THE ILEUM.

DR. WALTON MARTIN presented a woman, 42 years old, who was operated upon by him on November 6, 1907, at the Roosevelt Hospital in the service of Dr. Blake, for intestinal perforation.

The patient was admitted to the medical service on November 4th. Her statements were confused, and it was difficult to obtain a satisfactory history. Apparently, she had been ill for three or four weeks, having chills and fever and feeling prostrated and sick, but she was able during this period to do a little housework.

Three days before admission to the hospital, although feeling very weak, she attempted to cook dinner for her family, but while doing so, was seized with such severe cramp-like pains in the lower abdomen that she had to go to bed. Shortly afterwards she began to vomit and to have a diarrhoea. During the next day she became worse, and finally, three days after the onset of the severe pain, she sent for an ambulance and was brought to the hospital. On admission, the temperature was  $100.8^{\circ}$ ; pulse 124; respirations, 32; leucocyte count, 6200; polymorphonuclear, 84 per cent.; lymphocyte, 16 per cent. The woman looked ill. Her entire abdomen was slightly distended. There was no rigidity. It was more tender in the upper than the lower half. Spleen not felt. Vaginal examination negative.

The following day she had a chill lasting twenty minutes, the temperature rose to  $104^{\circ}$ ; the pulse to 140. The leucocyte count was 7000, and polymorphonuclear 90 per cent. No malarial organisms were found in the blood.

The next morning her temperature had fallen to  $100^{\circ}$ ; her pulse was 120; slight rigidity and tenderness were now present over the lower abdomen. She was transferred to the surgical division, an immediate operation having been advised.

Operation one hour later. Abdomen opened through a right intermuscular incision with an extension through the sheath of the rectus. The appendix showed secondary appendicitis of outer coats. There was gas in the pelvis. The coils of intestine in the lower abdomen were very heavily coated with large flakes

of fibrin. The pus had the characteristic odor of colon bacillus pus. The mesenteric glands were markedly enlarged. On pulling up a piece of gut from the pelvis, there was a gush of fluid feces, that had evidently been bound in by adhesions about a small perforation in the small intestine, about  $\frac{3}{8}$  of an inch in diameter. It was punched out in appearance. The heavy flakes of fibrin over the intestine made it impossible to say whether the perforation was in a Peyer's patch. The tubes, ovaries and uterus were apparently normal. The appendix was removed in the usual manner. The perforation in the intestine was closed by a silk purse-string suture, reinforced with catgut Lembert sutures. The abdominal cavity was carefully washed with normal salt solution. A double drainage-tube was introduced to the bottom of the pelvis, and the abdominal wall closed about the tubes.

The temperature after operation was  $101^{\circ}$ ; pulse, 108. During the following night her temperature reached  $105^{\circ}$  and her pulse 140. A positive Widal reaction was present three days later, and about a week later one of her children, who had been living with her on a barge in the North River, was admitted to the hospital suffering from typhoid fever.

The patient made a slow recovery, her convalescence being interrupted by residual abscesses, one on the left side, one between the bladder and a coil of small intestine, and one in the axilla. In opening the median abscess the bladder was torn and although the tear was sutured, there was a leakage of urine for several weeks. She is now in good health and rapidly gaining weight.

The patient evidently had ambulatory typhoid, with a perforation of a coil of intestine situated in the pelvis. The operation was performed five days after the onset of the severe abdominal pain.

DR. L. W. HOTCHKISS said he had seen a case very similar to the one reported by Dr. Martin. The patient was brought into Bellevue Hospital with the history of an illness dating back for some time. Abdominal symptoms had developed a few days before. Upon operation, a large encapsulated pelvic abscess was found in connection with a perforation of the small intestine. There were no positive evidences of typhoid at the time, but the perforation was probably due to a typhoid ulcer. Resection of the gut was done. The case resulted fatally.

DR. BLAKE referred to a case presented by him at a previous meeting in which the typhoidal perforation was of three days' standing at the time of operation. In that case there was first a pelvic peritonitis which at the time of the operation had become general.

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*Stated Meeting, March 11, 1908.*

The President, DR. JOSEPH A. BLAKE, in the Chair.

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## GASTRIC ULCER.

DR. ALEXANDER B. JOHNSON presented a woman, 47 years old, who was operated on by him in 1899 for carcinoma of the left breast. The tumor was small, occupying the upper and outer quadrant of the breast, and there was no axillary involvement. Nine years had elapsed since the operation, and there were no signs of a recurrence up to the present time. About two and a half years ago the woman began to suffer from gastric disturbance. She did not vomit, but there was a continuous gnawing pain in the epigastrium. The gastric motility was not noticeably impaired, and there were no evidences of dilatation. An analysis of the stomach contents showed hyperacidity. Although there was no history of hæmatemesis, it was thought that she probably had an ulcer of the stomach. The patient had lost much flesh, and the pain was so severe that her sleep was disturbed.

Upon exposing the stomach, in April, 1907, an indurated area was found in its wall, about midway between the pylorus and the cardiac end, in the region of the greater curvature. This area of induration was oval in shape, measuring three inches in one diameter and two and a half inches in the other. There was a notable amount of fibrinous peritonitis which had caused the stomach to adhere to the neighboring intestines and abdominal wall. Near the center of this indurated adherent area there was an ulcer of the stomach, which was just about to perforate. The mesenteric glands were more or less enlarged. The entire involved area was excised, and the wound was closed. The patient made a good convalescence, and there had been no return of her acute symptoms, although the hyperacidity continued and she still had a certain amount of gastric dyspepsia. At the time of opera-

tion, the stomach was not found to be dilated, and there were no evidences of pyloric stenosis.

The pathological diagnosis was chronic ulcer of the stomach. Around the ulcerated area, which was the size of a twenty-five cent silver piece, was a large area in which the mucosa and muscular wall of the stomach had been replaced by cicatricial tissue. There was no evidence of malignancy.

#### GASTRO-ENTEROSTOMY.

DR. ALEXANDER B. JOHNSON presented a man, 43 years old, who was admitted to the New York Hospital on December 16, 1907, with the following history: Eighteen months ago he had first noticed belching of gas, bloating of the stomach, and vomiting of watery, sour fluid. He also complained of pain after eating, and a burning sensation located under the sternum and radiating to the sides of chest and shoulder. This was relieved by vomiting. Shortly after his initial gastric symptoms he had an attack of severe gastric pain. He was taken to the House of Relief, where the diagnosis of perforated gastric ulcer was made and confirmed at an operation which was done by Dr. Tilton. Six weeks later the patient left the hospital, and remained well for three months, when his original symptoms returned.

Upon his admission to the New York Hospital he complained of pain in the epigastrium, with vomiting and loss of weight and appetite. An examination of the stomach contents after an Ewald test meal showed a total acidity of 87 per cent., with 38 per cent. of free hydrochloric acid; there were marked traces of blood and lactic acid; starch digestion was poor. To the right of the middle line, and about three inches above the umbilicus a hard nodular mass was felt in the region of the pylorus. The stomach was markedly dilated, and gastric motility was much impaired. The case was regarded as one of stenosis of the pylorus from gastric ulcer, with much scar tissue in the pylorus, or of the same condition with secondary carcinomatous degeneration. Upon opening the abdomen the stomach was found markedly dilated. The pylorus itself and the stomach wall near the pylorus were hard and appeared to be extensively infiltrated with scar tissue. The appearances seemed to be the result of chronic ulceration rather than of malignant disease. A posterior gastro-enterostomy was done by the suture method and the short jejunal

loop. Fine chromic gut was used for the inner row of sutures, and Pagenstecher thread for the outer. Since the operation which was done on January 31, 1908, the patient had not vomited, he was on ordinary diet, and had had no gastric discomfort. He had gained thirty-one pounds in weight. He had resumed his work.

DR. BENJAMIN T. TILTON, who had done the original operation for perforated gastric ulcer in the case shown by Dr. Johnson, said the operation was done about six hours after the perforation had occurred. A small opening was found in the anterior stomach wall near the pylorus, and there were evidences of a beginning suppurative peritonitis. The operation consisted in simply excising the involved area and putting in a few inverting sutures. Subsequent to the operation, the man developed an attack of right lobar pneumonia, but otherwise made a good recovery.

#### APPENDICITIS: MISPLACED APPENDIX.

DR. JOHNSON presented a boy, 12 years old, who was admitted to the New York Hospital on January 26, 1908. The history obtained was that two days before admission he was seized with severe abdominal pain which was referred at first to the umbilical region. On the day prior to admission the pain became general and had progressively increased in intensity. The patient had vomited once; the bowels had moved to catharsis. He had moderate fever and leucocytosis, with a relative increase of the polynuclear cells.

Upon examination, the lower half of the abdomen was found to be quite rigid, the tenderness not being more marked on one side than the other. The symptoms seemed to point to the appendix, although the tenderness was perhaps most marked just below the umbilicus. The case was regarded as one of perforative appendicitis, with abscess formation and a probably spreading peritonitis.

On making the usual abdominal incision, no cæcum nor ascending colon could be found, nor could the transverse colon be made out. The case was thereupon regarded as one of those rare instances of failure of rotation of the intestines during foetal life, and a left intermuscular abdominal incision was made. The small intestine was found to have a mesenteric attachment ending below at an unusually high point. The cæcum lay to the left

of the median line at the level of the body of the fourth lumbar vertebra. The ileum entered the cæcum from right to left. From the cæcum the colon extended upward to the cardia of the stomach and then downward in one or two irregular coils, with a very short sigmoid, into the rectum. The very long appendix extended downward to the bottom of the pelvis in front of the rectum crossing it from right to left. The tip of the appendix was gangrenous and perforated. It lay in an abscess of moderate size surrounded by an area of fibrinous peritonitis. The appendix was removed in the usual way. The child made a good convalescence from the operation but on account of the great depth of the abscess a small sinus, now only one inch deep remained.

DR. GEORGE E. BREWER said that about a year ago he saw a case very similar to the one presented by Dr. Johnson. The patient was admitted to the Roosevelt Hospital with symptoms of an acute abdominal inflammation, the whole lower abdomen being more or less rigid, but the symptoms being slightly more marked on the right side. When the abdomen was opened through a Kammerer incision the speaker said he was surprised to find only small intestine on the right side. Thinking this was due to an incomplete descent of the cæcum, he extended his incision upwards, but found nothing suggesting large intestine. Upon retracting the incision towards the median line he discovered the colon, and further investigation showed a perforated misplaced appendix.

DR. JOSEPH A. BLAKE said he had seen two cases like those described by Drs. Johnson and Brewer, and he thought the diagnosis could best be made by carrying the exploration up to the duodenum. The cæcum could only be brought over to the right side by rotation of the gut, and when this failed to occur the mesentery was straight, and the cæcum remained in the median line. With incomplete rotation we would find the cæcum in close relation to the liver.

STAB WOUND OF HEART; SUTURE; DOUBLE LOBAR PNEUMONIA; EMPHYSEMA; THORACOTOMY; DRAINAGE.

DR. JOSEPH A. BLAKE presented a negro, 24 years old, who was admitted to the Roosevelt Hospital on December 13, 1907.

While drunk, about two hours before admission, he had been stabbed in the chest. He at first took little notice of the injury

and walked a block, when he had to sit down on the curb on account of weakness. He was found by the ambulance surgeon in good condition but, on arriving at the hospital, became rapidly worse.

On admission, a stab wound, 2 cm. long, was found over the fourth costal cartilage, a cm. within the nipple line. The wound was bleeding moderately, and occasionally bubbles escaped. The area of cardiac dulness was increased. The heart sounds were inaudible; the radial pulse was barely perceptible and was irregular in force and rhythm.

A diagnosis of wound of the heart was made by Dr. Dwight, the house surgeon, and Dr. Blake was summoned immediately, reaching the hospital by the time things were prepared for operating.

The operation was performed under drop ether anæsthesia, about two and one-half hours from the reception of the injury. On account of the implication of the pleura, made evident by the bubbles escaping from the wound and the signs of fluid and air in the chest, he decided to open the pleural cavity; therefore, a rectangular flap was cut, embracing the third, fourth and fifth costal cartilages, and turned over the sternum, the cartilages being cut at the ribs and broken at their sternal attachments. The fourth costal cartilage was found to have been already divided. The pleural cavity was thus widely opened, disclosing a wound somewhat over a cm. long in the pericardium, from which blood was flowing. The pericardium was then opened parallel to its attachment for a distance of 6 cm. It contained about two ounces of clotted blood. Close to the anterior coronary artery there was a wound in the right ventricle, one cm. long, from which a small fountain of dark blood played for a distance of 10 or 12 cm. at each systole. The hemorrhage was easily controlled by gentle pressure. The wound was closed with three interrupted sutures of fine silk, passing through the entire thickness of the ventricular wall, and there still being a little oozing, a Halsted mattress suture was placed over them. The sutures were introduced with some difficulty owing to the propinquity of the coronary artery but, by grasping the heart fairly firmly in the left hand, its action was interrupted sufficiently to permit accurate insertion. The blood was then washed from the peri-

cardium and the opening in it sutured. The blood in the pericardium was clotted, but that in the pleura was fluid and amounted to about two pints. This was removed by sponging, and the flap was turned back, the wound being closed without drainage, excepting a piece of tape introduced into the stab wound, which communicated with the deep portion of the operation wound. The costal cartilages were sutured with chromicized catgut. There was no injury to the lung.

The pulse was steady after the operation, averaging 108, and was of good force. The temperature was subnormal, 96°. This was followed by a reaction to 101°. The next day the temperature averaged 104°; the pulse varied from 112 to 136, the respirations from 28 to 64. Signs of consolidation of the lower lobes of both lungs appeared, the temperature during the following week ranging between 102° and 105°. The operation wound healed by first intention, but the stab wound became grayish and sloughing. After the tenth day, the temperature ran lower, but was of the septic type, and pus discharged from the wound, the operation wound being partially opened to increase drainage. The heart's action was extremely good during all this period.

The pleural cavity, however, drained imperfectly through the anterior incision, and on the twenty-sixth day a portion of the ninth rib in the scapular line was removed, and a drainage tube inserted. This was followed by immediate improvement, and the lung gradually expanded, the sinuses finally closing. He was discharged on the fifty-ninth day in good general condition.

At present, three months after the injury, he was in good condition, although he felt the effect of the prolonged sepsis. The heart's action was regular; there was a friction sound. The wounds were completely healed.

#### REDUCTION OF FRACTURE-DISLOCATION OF SPINE AFTER LAMINECTOMY.

DR. CLARENCE A. MCWILLIAMS presented a man, 34 years old, who was admitted to the Presbyterian Hospital on September 4, 1906, at 8 P.M. The history obtained was that at 1 o'clock that afternoon, while bending over and hammering some nails into a board, he was struck in the middle of the back by a heavy pile, which knocked him flat. He was unable to move afterwards,

and was brought from the Port Chester Hospital on an air mattress lying flat on his face.

Examination showed an extensive swelling, the size of a large saucer, over the lower dorsal and lumbar region. It was evidently a hæmatoma, but under this was felt an irregular mass between the spinous processes of the twelfth dorsal and first lumbar vertebræ. The projection of the twelfth dorsal process was much more marked than that of the first lumbar. Palpation of the involved area was very painful, as was also any motion of it. There was a total loss of motion below the line of fracture. The soles of the feet were completely insensitive, and this extended up to the middle of the calves. Both popliteal spaces were somewhat hyperæsthetic, and pain and temperature sense was entirely absent over the back of both lower extremities. The plantar reflexes were absent. On the posterior thighs he could distinguish the prick of a pin from friction of the fingers, but he could not do so on the back of the calves. In the position occupied by the patient, no satisfactory examination of the anterior reflexes or sensations were possible. There was retention of urine, necessitating the use of catheter. No priapism.

The case was regarded as one of incomplete crushing of the cord, well suited for surgical intervention, and the patient was operated on at 11 P.M., ten hours after the receipt of the injury. A four-inch incision was made over the tenth, eleventh and twelfth dorsal and first lumbar vertebræ, and a large amount of subcutaneous effused blood escaped. The finger could now be passed directly down to the spinal cord, between the eleventh and twelfth dorsal vertebræ as the interspinous ligament was torn. The muscles were cut away from the laminæ, and the spinous processes and laminæ of the eleventh and twelfth dorsal and first lumbar were removed. Bleeding was easily controlled by packing. The articular process on the upper left side of the twelfth dorsal seemed to be empty and was directed inwards and upwards, while the lower articular surface of the eleventh dorsal was resting just in front and above the articular surface on the upper side of the twelfth. On the opposite side of this there was a fracture which extended through the eleventh and possibly the twelfth transverse processes, internal to the articular surfaces. Several small fragments of bone were removed. The dura seemed uninjured, but was arched over the projection caused by the body of

the twelfth dorsal vertebra. A hypodermic needle introduced through the dura brought clear fluid, without blood. The dura was not opened. The dislocation was reduced by traction of an assistant on the patient's left shoulder, and traction by a second assistant on the pelvis and thigh; at the same time the operator exerted pressure on the opposite right lumbar region, the object being to rotate the man's trunk so as to separate the articular processes, if possible. This was finally accomplished by prying the edge of the eleventh articular process upward by means of a periosteal elevator. When this was done, the left shoulder was twisted posteriorly, and the edge of the articular process on the under surface of the eleventh rode over the upper edge of the articular process on the upper surface of the twelfth. Great force was necessary to accomplish the reduction. The muscles were then sutured, and a rubber drainage tube inserted. The operation, which lasted one hour, was well borne by the patient. Two long padded splints were placed along either side of the vertebral column, and bound down by adhesive plaster. Two muslin jackets were then placed around him. These pads were left undisturbed for six days, and during that period his temperature never rose above 100. On the sixth day a plaster jacket was substituted, and after this had hardened the patient was turned over on his back. His wound healed by primary union. Catheterization was necessary for nine days, the procedure each time being followed by a boric acid bladder irrigation, and urotropin was administered by mouth. At no time were there any evidences of cystitis. On the ninth day urination became involuntary; this was not the overflow of retention, for a catheter introduced on several occasions withdrew no residual urine. By the end of the second week he became conscious of the desire to urinate, but he could not retain his water when the desire came. The same was true of defecation. Constipation was absolute for several months. A week after the operation he began to have lancinating pains down the legs, and on the thirteenth day he could barely twitch the three left outer toes. The sensations of touch and pain had extended downwards to include all the surfaces of both legs, excepting the plantar surfaces, but was much less acute on the right than on the left side. On the nineteenth day he could move all the left toes and could flex the leg very slightly. The right toes could only be twitched slightly. On the thirty-fifth day he began

to contract the left quadriceps; the leg could be well flexed and the movements in the left toes were vigorous. The right lower extremity showed much return of power, but he could move all the toes slightly and there was an intimation of contraction of the right quadriceps.

On October 30, 1906, fifty-two days after the injury, a neurological examination was made by Dr. J. Ramsay Hunt. At this time slight flexion of the right toes and hip was possible, while on the left side the improvement was more marked. There were indistinct flexion and extension movements in the toes, ankles and knees. On both sides, knee and ankle jerks were present and exaggerated. On the right side there was ankle clonus; none on the left. Babinski on right; none on left. Tactile sense was impaired over both lower extremities. Pain sense was much impaired over both extremities; also the temperature sense.

The patient continued to gradually improve, and sat up in a chair on November 17, 1906, seventy-four days after the operation. On the ninety-fifth day he began using a walking machine, and on the one hundred and fourth day was able to get around on crutches. He left the hospital on December 21st, one hundred and eight days after the operation. For three months longer he used two crutches, and then for two months he used one crutch, which he at that time discarded for a cane. Neurological examination by Dr. J. Ramsay Hunt, on September 12, 1907, one year after the operation. Still has occasional shooting pains below the knees but gradually diminishing in intensity. Vesical function shows a little retardation but no incontinence. Sexual desire impaired but erections occur. Station is good. Gait typically spastic, the right leg showing a greater involvement than the left. Ankle clonus on both sides and bilateral Babinski. Abdominal reflexes present, left cremasteric present but right absent. The superficial sensations of touch, pain and temperature are diminished below the knees. The deep sensibility of the toes is well preserved. Stands and walks perfectly well without assistance.

Note, April 2, 1908, one year and seven months after the operation. The patient is able to rise from a chair and stand and walk without any assistance whatever. There is good movement and fair strength in both lower extremities but the gait is still typically spastic and shows a slight improvement over the

previous examination above. Tactile sensibility is still diminished below the knees in both extremities. He asserts that his erections are growing stronger and that he is able to have coitus about once a month. His back is perfectly mobile in all directions and appears to have lost no strength. The right leg is stronger than the left but somewhat more spastic.

DR. GEORGE WOOLSEY, who had seen the patient shown by Dr. McWilliams prior to and at the operation, said it was very evident at the time that any reduction of the dislocation would have been difficult, if not impossible, without the open method. Even by this method reduction was not easy to accomplish, and the case was an illustration of the fact that in similar cases of fracture-dislocation of the spine where radical interference is indicated, the open method is far easier and safer than any external manipulations. Surgeons are not justified, of course, in operating on all cases, but when active treatment is indicated, operation is far better than manipulation.

#### NEPHRECTOMY FOR TUBERCULOSIS OF THE KIDNEY AND URETER.

DR. GEORGE D. STEWART presented a man, 39 years old, who three years ago first noticed that his urine was yellow, and looked as though it contained pus. Urinated six to ten times daily. Each urination was accompanied and followed by more or less smarting. On physician's advice took infusion Buchu; condition improved. Two years ago on return of same symptoms, he consulted a physician who treated him for nine months. About this time he first noticed pain in his left side. It was dull, persistent in character, most severe in bad weather. Each attack lasted about a day; thought it was rheumatism. He was cystoscoped and treated locally. However he became gradually worse. Began to lose weight. Had attacks of chills, fever, and sweats at intervals, four in the last six months. All of his other symptoms returned, except he states that the urine was clear, becoming, however, cloudy on standing.

October 21, 1907. He went home and urinated before retiring. Ten minutes later, he states that he passed a quart of urine; one hour later another quart. At this time he noticed a lump in his left side, which was not painful, was movable and

about the size of an orange. He went to St. Vincent's Dispensary the following day and was referred to the hospital.

*Physical examination* shows mass in the left lumbar region extending beyond median line. Above it disappears beneath costal margin, below extends into false pelvis, firm in consistency, not tender, movable with respiration, skin not involved fluctuation not elicited. Amount of urine in twenty-four hours was 60 ounces. Color, amber. Reaction, acid. Specific gravity, 10-10. Albumen, moderate trace. No sugar. Microscopic, few red cells, few pus cells.

*Operation*, October 26, 1907. Incision from angle between erector-spinae muscles and last rib, forward towards crest of ileum, then directly forward to outer edge of rectus abdominis. Mass exposed found to be adherent to peritoneum and intestines, particularly the transverse mesocolon. Tumor dissected from diaphragm. The adhesions were difficult to tear, and in separating them an abscess was opened and contents escaped into the open peritoneal cavity; not invading the latter to any extent, however, as it had been rather carefully walled off with pads. The pedicle was tied and cut and the *ureter*, which was manifestly involved in the tubercular process and about the size of a finger, was cut beyond the pelvic brim. Because of the size of the large mass, considerable quantity of gauze packing was placed in the wound. Skin was sutured and entirely closed except at posterior angle.

*Pathological Report* of Dr. Harlow Brooks. Microscopic examination of the greatly hypertrophied kidney removed shows practically the entire non-necrosed area to be made of a diffuse type of granulation tissue of low vitality, showing frequent areas of necrosis. Numerous tubercles are found scattered from place to place, but they are apparently of recent origin and seemingly younger than the accompanying simple inflammatory lesions. From this fact, one might surmise that the tubercular process was secondary.

*Subsequent History*.—Patient out of bed on twenty-first day; gained thirty pounds in two months; since operation has had no symptoms referable to kidneys, except that on two occasions he has had to rise during night to urinate. Examination of urine shows it to be normal with no evidence of tubercular bacilli. Recently the patient has had several small carbuncles on his back,

but they have not interfered with his general health or gradual increase in weight.

Patient is presented to show the good results of a not too radical operation for kidney tuberculosis. In this instance a certain amount of the ureter involved in the tubercular process was left behind, and yet the patient shows neither local nor constitutional symptoms. It would appear that the tendency in recent years not only in genito-urinary tuberculosis, but also in the surgery of tubercular glands, joints, etc., has been towards conservatism and the outcome in this case adds, it seems, its quota of evidence in favor of such a course.

BENIGN STRICTURE OF THE ŒSOPHAGUS; GASTROSTOMY;  
DILATATION BY THE STRING METHOD.

DR. GEORGE D. STEWART presented a man, 40 years old, who was admitted to Bellevue Hospital on February 20, 1907. His family and past history was negative.

About four months ago patient mistook a glass of washing soda for water, and drank some. Thinks he spat it all out at once, but not sure. Washed out mouth at once and drank water. For few hours after he had burning sensation at the level of the lower part of larynx. Ever since he has had pain in this region when he swallows also has had pain in epigastrium immediately after eating, and relief only after vomiting. Three weeks after taking the soda he began to vomit after eating. At first this was intermittent but increased in frequency. Sometimes the vomiting ceased for three or four days at a time. The vomitus was never large in amount, one to two cupsful at most; never sour; returned milk never clotted. No blood. Has lost 40 or 50 pounds.

February 27, 1907. On account of his extreme weakness a gastrostomy was performed according to the method of Senn.

Following his operation he gained 45 pounds in about six months. The gastrostomy was most efficient. Discharged September, 1907.

February 18, 1908. Patient was re-admitted to ward for the purpose of having his stricture treated. He had continued to gain in weight and was properly nourished. He also reported as being able to swallow a little water. An attempt was therefore made to get a string into his stomach by having the patient

swallow it, which was successful. The string after entering the stomach was washed out through the gastrostomy wound. With this fine string a larger silk one was drawn through the œsophagus. Then a bougie, about No. 28 French, was easily drawn through. Following this he was able to swallow, and since that time the bougies are being increased in size. The patient is now able to swallow perfectly, and has discontinued using his gastrostomy opening.

DR. BLAKE said that in cases where the string could be introduced into the stomach by swallowing, it could readily be recovered through the gastrostomy wound by first throwing some water into the stomach and then sucking it out through a tube or catheter. If the string could be swallowed without difficulty, it was scarcely necessary to keep it permanently *in situ*.

DR. F. KAMMERER said that by simply inserting a drainage tube through the gastrostomy wound of the patient in the erect position and instructing him to swallow water, the end of the string would come out through the tube. The speaker said that in tubular strictures, especially those of the cicatricial variety located near the lower end of the œsophagus, he had found that while dilatation with bougies was very simple to a certain degree, it was often impossible to dilate any farther, to a degree permitting easy deglutition. The stricture was very apt to become irritated and to re-contract. He had in mind one case where after cutting by the string method he had introduced bougies for eighteen months without accomplishing much more later on than had been accomplished almost immediately after the cutting operation.

DR. CHARLES N. DOWD said that he had obtained excellent results by following the suggestion of von Hacker in stretching out a piece of rubber tubing and drawing it into the stricture: the steady pressure of the rubber quickly dilated a soft stricture to the stage where ordinary bougies could be used through the mouth.

DR. KAMMERER said that he had tried the permanent rubber tube in the case he had just referred to, but it was not borne well by the patient, and apparently gave rise to irritation and fever. The ease or difficulty of dilating these strictures depended very much on the nature and size of the constriction.

## INTERSTITIAL NEPHRITIS WITH MULTIPLE ABSCESS FORMATION.

DR. GEORGE WOOLSEY presented a woman, 28 years old, who was admitted to the Gynecological Service of Bellevue Hospital on January 6, 1908, complaining of headache, backache, nausea, pain in the abdomen, vaginal discharge and perineal weakness. She had a cystocele, a small rectocele, a retro-flexed uterus and a relaxed perineum. On January 14th Dr. Barrows did a perineorrhaphy and a double Alexander operation, and the patient was discharged on January 30 in good condition.

She was re-admitted to the Surgical Division on February 5 with the history that during the night prior to her admission she had had a chill, followed by fever and nausea, but no vomiting. She complained of a severe pain in the right hypochondriac and lumbar regions, and stated that she had some cough, with blood tinged sputum. She was poorly nourished, and the physical signs at the apex of the right lung indicated tubercular trouble. There was marked rigidity of the upper right rectus and in the right lumbar region. On palpation, a very tender mass was felt below the right costal margin. This moved slightly with respiration. Her temperature on admission was 104; pulse, 140; respirations, 32. Leucocyte count, 15,000. The urine contained a heavy trace of albumin and a marked trace of indican. No blood nor tubercle bacilli; no casts. The patient micturated from two to four times at night: there was no frequency during the day. A cystoscopic examination made by the Kelly method showed that there was no congestion about the mouths of the ureters nor of the bladder generally.

Operation, February 14, 1908. When the abdomen was opened through a small exploratory incision through the right rectus the right kidney was found to be much enlarged. The other organs were apparently normal. The kidney was then fully exposed through a lumbar incision. The fibrous capsule was very adherent to the fatty capsule, and the former was torn in freeing the kidney. The kidney showed numerous elevated areas of lighter color and various size, round and oval, and softer than the main portion of the organ. A nephrectomy was done, from which the patient made an uneventful recovery.

A pathological examination of the removed kidney showed it to be the seat of an acute interstitial nephritis, with multiple

abscess formation. Smears showed diplococci; no tubercle bacilli. Cultures gave a colon bacillus-like growth.

Since the operation, the patient's symptoms had improved, and the nocturnal frequency had diminished. The case was not regarded by the pathologist as one of infarct of the kidney, but as an acute interstitial process, with marked leucocytic infiltration, which was beginning to break down into small abscesses.

DR. GEORGE E. BREWER said the gross pathological appearance of the lesions in the specimen shown by Dr. Woolsey seemed to be of the same type as those described under the name of hemorrhagic infarcts. The speaker thought it was undoubtedly a blood infection. We could get a good many different microscopic appearances in these cases, which was explained by Albarán on the ground that in a kidney excreting bacteria from the blood, many different pathological conditions might occur. Primarily, however, they originated from a blood infection, and were due to the fact that the bacteria were carried into the arteries.

DR. BLAKE said he had seen quite a number of cases in which the appearance of the kidneys was typical of the specimen shown by Dr. Woolsey, and, like Dr. Brewer, he had always looked upon them as the result of an infection carried by the arteries. They also closely resembled the lesions found in early tuberculosis of the kidney. Here we had to deal with small multiple foci which later on might perhaps coalesce and form a condition resembling infarct.

#### EXCISION OF CARCINOMA OF THE RECTUM BY THE COMBINED METHOD.

DR. JOSEPH A. BLAKE read a paper with the above title for which see page 80.

DR. WOOLSEY said the combined method possessed one advantage which was perhaps not always sufficiently emphasized, namely, that it allowed the operator to learn the extent of the pelvic involvement in a way that could not be secured by the parasacral method. The speaker said that when he employed the latter method he was in favor of doing a preliminary colostomy, and in this way discovering the extent of the disease in the pelvis. With the combined method we could go right ahead and remove much more extensive growths, or determine whether they were operable or not.

DR. BLAKE, in closing, said that in none of his cases had he made an attempt to construct a competent abdominal anus other than bringing the end of the bowel through an ordinary McBurney intermuscular incision. He rather hesitated to employ the procedure of separating the muscle planes and drawing the end of the gut through between them, because he felt that unless great care was taken regarding the blood supply, there was some danger of necrosis. He had found the pneumatic ring a rather good arrangement. In operating, he always took some pains to leave a long segment of the gut, so that there was a loop hanging down into the pelvis, which acted as a sort of reservoir for the feces, and prevented a constant discharge. Such an arrangement gave the fluid portion of the feces time to be absorbed.

# TRANSACTIONS

OF THE

## PHILADELPHIA ACADEMY OF SURGERY.

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*Stated Meeting, March 2, 1908.*

The President, DR. WILLIAM J. TAYLOR, in the Chair.

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### CARIES SICCA.

DR. MORRIS B. MILLER presented a woman, aged 22 years, whose personal history was without interest until five years ago when she suffered from a prolonged and severe attack of typhoid fever complicated with pneumonia. Approximately two months after she got perfectly well her arm became weak at the shoulder and remained that way until something over a year ago when within a few weeks she lost entirely the power to raise it at the shoulder and it commenced to pain. The muscles became shrunk and the fixation grew pronounced over a period of three or four months. From the first she has had severe pains resembling neuralgia but not responding to any form of treatment. These are mainly of the area immediately surrounding the joint, but some pain is referred down the arm. Any effort to move the firmly ankylosed shoulder-joint causes considerable suffering. The clinical phenomena are clearly those of caries sicca. There is no pulmonary lesion perceptible.

Dr. Miller said he believed this condition must occur more frequently than one would gather from the literature, and he thinks it may possibly be that this condition is frequently diagnosed as arthritis. He would like to have raised the question whether, in the light of the disability his patient presented, and particularly the neuralgic pain of which she complained, an excision would be warranted and whether it would result in an improved condition.

RESECTION OF SPINAL ACCESSORY NERVE FOR  
TORTICOLLIS.

DR. ROBERT G. LE CONTE exhibited a boy of eleven upon whom he had operated six months previously for congenital torticollis. The patient's head, from birth, had been drawn to the right side, with the chin towards the right shoulder, and it was impossible for him to bring his face to the front. The right sternocleidomastoid muscle appeared to be twice as thick and strong as the left. With an anterior incision at the upper portion of the sternocleidomastoid the spinal accessory nerve was exposed before it entered the sternomastoid muscle. It was resected for a distance of half an inch.

The patient made an uneventful recovery, and now has perfect control and freedom of the motions of the head in all directions.

## RUPTURE OF THE SPLEEN.

DR. GEORGE G. ROSS read a paper on Rupture of the Spleen, with Report of Cases, for which see page 66.

DR. JOHN H. GIBBON referred to a case of rupture of the spleen which he had reported before the Academy some years previous. He believed that localized tenderness and rigidity were the most valuable symptoms we have for locating the injured viscus. In nearly all of the cases of rupture of the spleen which have been reported there has been marked localized tenderness and rigidity. Dr. Gibbon believed that if the spleen were not so easily removed fewer splenectomies for rupture would be reported, since in the majority of these cases hemorrhage can be controlled by judicious packing. In order to control bleeding from large wounds of the spleen it may be necessary to crowd the spleen firmly up against the diaphragm. Dr. Gibbon believed that any case that lived for four or five days after the rupture had occurred could be saved without splenectomy.

## END-TO-END ANASTOMOSIS OF THE BRACHIAL ARTERY.

DR. FRANCIS T. STEWART reported the following cases:

CASE I.—A. L., aged 42 years, was admitted to the Pennsylvania Hospital June 14, 1905, in the service of Dr. Le Conte, to whom the author is indebted for the privilege of operating upon and reporting this case. The patient had been struck on the inner

side of the arm just above the elbow with a piece of flying steel. The profuse bleeding which followed was readily controlled by pressure. Subsequently the arm became greatly swollen, the skin tense, and a number of large blisters appeared over the forearm. The radial pulse was absent. The X-ray showed the piece of steel,  $\frac{3}{8} \times \frac{1}{8}$  inch in size, just beneath the skin. Two days after the injury a 5 inch incision was made along the inner side of the biceps, and the brachial artery exposed at the upper angle of the wound and compressed between the fingers of an assistant. The vessel was then traced downwards until the wound in its walls was found. The piece of steel was removed with the mass of clots which surrounded the artery. The wound in the artery was transverse and involved half of its circumference. One of the brachial veins had been severed, but was closed by agglutination of its walls the result of compression. After ligating the vein the arterial wound was sutured with through and through sutures of fine silk, which controlled the bleeding but also dangerously narrowed the lumen of the artery. The injured segment of the artery was therefore resected and an end-to-end anastomosis performed by the Murphy method. This necessitated flexion of the elbow, in which position the arm was dressed on an internal angular splint. The radial pulse had disappeared by the time the dressing was completed, but reappeared the following day, although very feeble. The wound was not drained, and primary union occurred. Two months after operation the forearm could be almost completely extended, the radial pulse was as strong as on the sound side, and there was some neuralgic pain along the course of the median nerve.

CASE 2.—J. M., aged 32 years, was admitted to the Germantown Hospital, May 22, 1906, with a bullet wound on the inner side of the right arm just below the axilla. The following day the arm was greatly swollen and the radial pulse absent. The artery was exposed and compressed as in the preceding case, and a lacerated wound involving three-fourths of the circumference of the vessel found. As approximation of this wound obliterated the lumen of the vessel, the injured portion was resected, and the ends united with silk sutures passing through all the coats. After turning on the circulation a few additional sutures were applied to control the oozing. The wound was closed without drainage and healed by first intention. A feeble radial pulse

could be felt immediately after the operation and this increased in strength from day to day. The bullet could not be found at the operation nor could it be shown by an X-ray plate.

Dr. Stewart said further that in addition to the above cases 8 others had been reported in which circular arteriorrhaphy had been performed for accidental wounds (1897, Murphy, Djemil Pacha, two cases; 1899, Kümmel, Krause; 1902, Fergusson; 1904, Delanglade; 1906, Brougham), not including cases of aneurysm. Of these 10 cases the axillary artery was involved in 3, the brachial in 2, the radial and ulnar (same patient) in 1, the femoral in 3, and the popliteal in 1. In 3 the wound was caused by a bullet, in 1 by a piece of steel, in 1 by a stab wound, and in 5 the vessel was accidentally opened during a surgical operation. The largest amount of vessel resected was 2 inches (femoral). In 7 cases the vessel was united with silk; in 3 the suture material was not mentioned. The Murphy method was employed in 8 cases and simple approximation in 2. In 5 cases the peripheral pulse could be felt at the close of the operation and in 5 it was absent immediately after the operation. Infection occurred in at least 3 cases and gangrene in 2 (femoral and popliteal). In no case was secondary hemorrhage or aneurysm reported.

At the present day ligation is contraindicated for a clean wound of a large artery. Unfortunately in the very cases in which arteriorrhaphy for wounds is most strongly indicated, *i.e.*, in those with chronic arteritis, in whom the danger of gangrene after ligation is much increased, the sutures are apt to tear out during the operation or thrombosis is likely to occur subsequently. Even in these cases, however, he believed arteriorrhaphy should be tried, since when one considers the probability of section of the vessel by a ligature, the dangers of suture are at least no greater than ligation, and in the event of thrombosis the patient is no worse off than after the application of a ligature; indeed if the thrombus forms slowly the collateral vessels may sufficiently dilate to prevent gangrene in the affected part.

Dr. JOHN H. GIBBON thought that in Dr. Stewart's first case a prompt clot had formed at the site of anastomosis. This is indicated by the disappearance of the radial pulse before the patient left the operating table, and its gradual reappearance would indicate the establishment of collateral circulation. In this case the invagination method was employed which is now recog-

nized as being faulty, because there is not a close contact between the intima of the two portions of the divided vessel. In Dr. Stewart's second case he did an end-to-end anastomosis with a close approximation of intima, and there was evidently no obstruction after the operation. Dr. Gibbon believes with Dr. Stewart that arteriorrhaphy is to be preferred to ligation wherever possible.

DR. STEWART thought Dr. Gibbon's criticism was correct, and that thrombosis must have occurred in the first case. In his report he simply classed the cases according to whether the pulse was or was not present immediately after operation. Although his report shows that 8 of the 10 cases were done by the Murphy method, Dr. Stewart thinks there can be no doubt that the simple approximation, or the Carrel circular arteriorrhaphy is to be chosen by all means. He was at first going to say that he did his second case by the Carrel method, but was afraid Carrel might object as the edges were slightly inverted instead of everted, and he did not use the guide sutures of that surgeon.

Dr. Stewart thinks that the Murphy method is little used at the present day, although it was the pioneer one and paved the way for the progress which has been made along this line.

#### GUNSHOT INJURY OF THE LEFT HYPOGLOSSAL NERVE.

DR. JOHN B. ROBERTS reported this case, as follows:

A man was admitted to the Polyclinic Hospital on the 28th of March, 1907, with a gunshot wound of the left cheek over the ramus of the lower jaw. The point of entrance was about three-quarters of an inch below and about three-quarters of an inch in front of the lower edge of the lobe of the ear. The tongue when protruded pointed very much to the left (Fig. 1), showing that the hypoglossal nerve was paralyzed. The left side of the man's face was covered with sweat, and the left pupil slightly dilated suggesting irritation of the sympathetic nerve.

Dr. William G. Spiller examined the patient two days after his admission and supplied the following notes:

The left facial nerve is very paretic but not completely paralyzed. The upper branch of the nerve has probably escaped injury. The man can nearly close the lids of the left eye. The left side of the tongue is completely paralyzed. The organ while in the mouth deviates to the right, but is greatly deviated to the left when protruded. He is unable to move the tongue to the

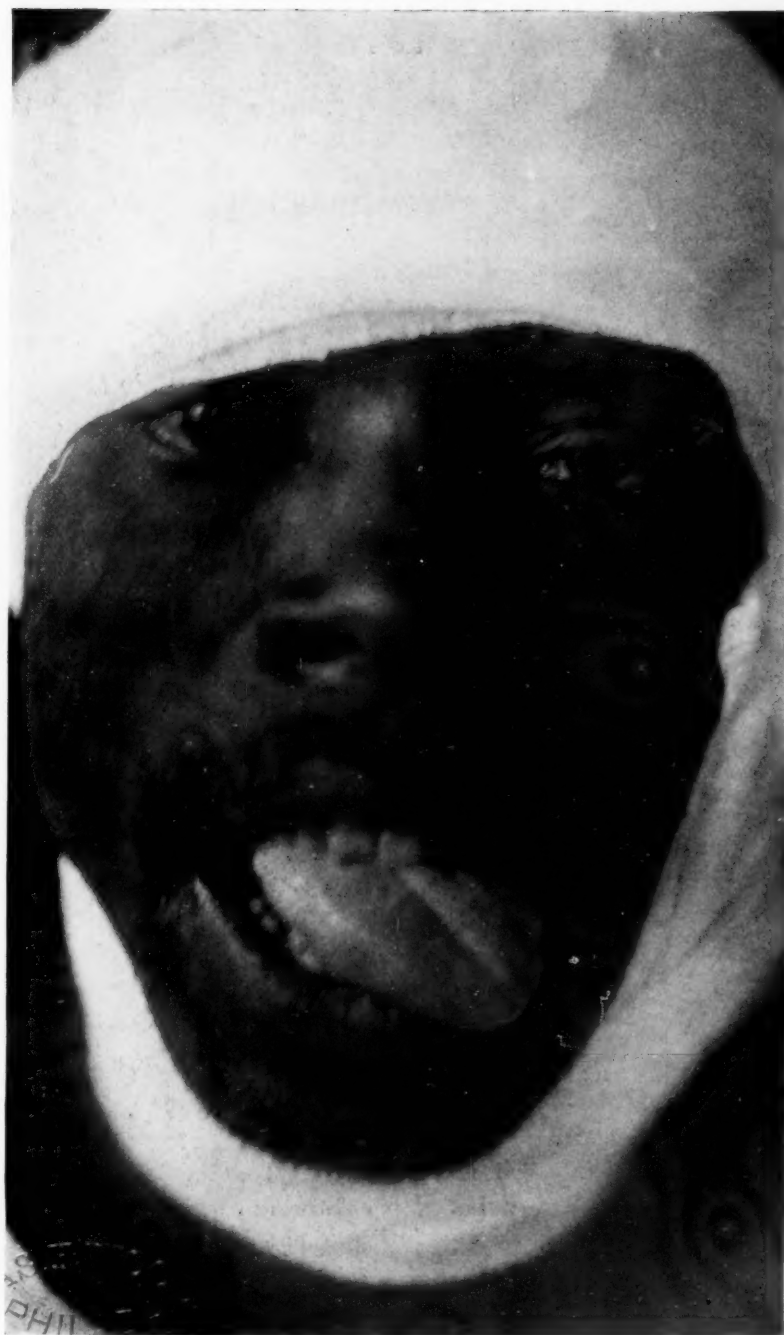
left, except a very little beyond the median line, unless it is protruded. This shows injury to the hypoglossal nerve. The soft palate is moved well on both sides when he says "Ah!" and is not paralyzed. He swallows fluids without difficulty when he is sitting up. The pneumogastric and glossopharyngeal nerves have probably escaped injury. The sympathetic has been injured.

He sweats profusely on the left side of the face. The sweating also extends down to the upper part of the shoulder and upper part of the left arm. The right side of the face is dry. The jaw is not deviated when his mouth is open (Fig. 2). The masseter muscles contract well on both sides. Sensations of touch and pain are normal on both sides of the face. Salt and sugar are both well tasted on the left side of the tongue. The grasp of the hands and the power of the legs are normal. There are no symptoms of involvement of the brain.

The left pupil is slightly dilated but seems to react to light.

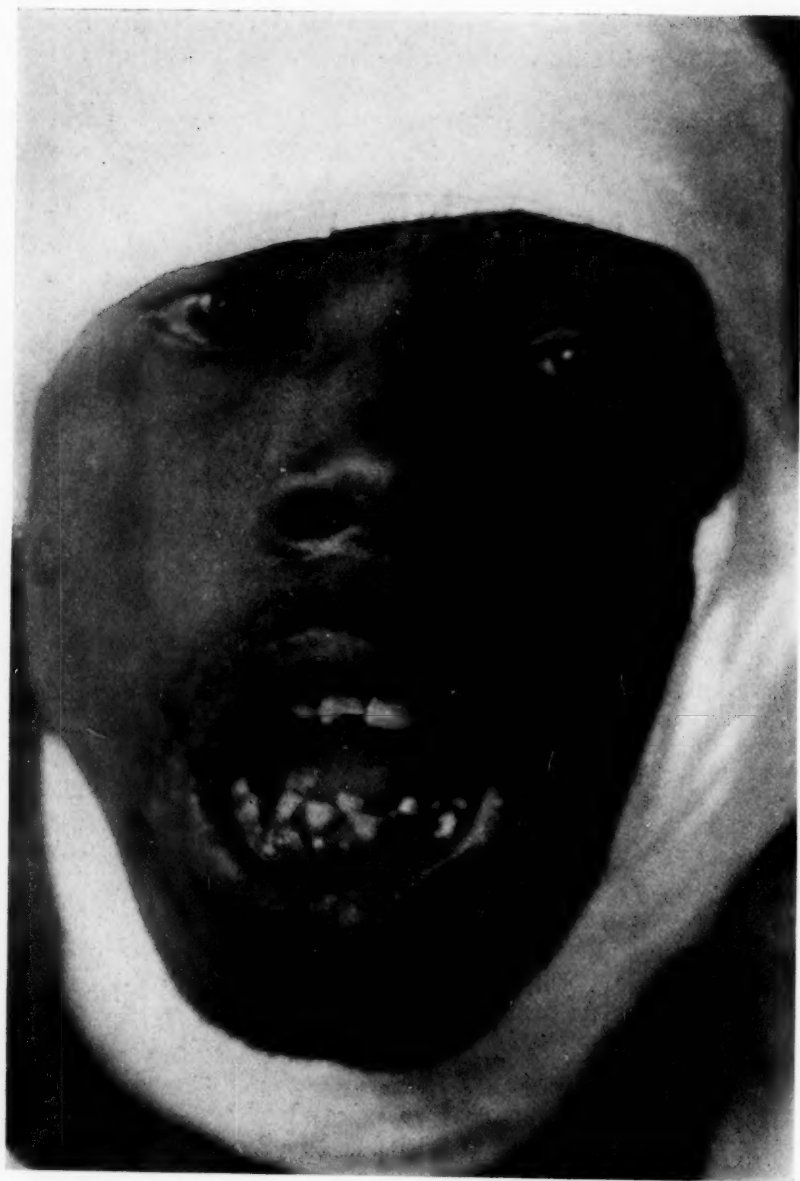
On April 3d, after locating the bullet by means of two X-ray pictures, Dr. Roberts operated for extraction of the missile. The wound in the cheek was suppurating, though it had been packed with iodoform gauze. The probe showed that the bullet had gone through the ramus of the mandible a short distance below the sigmoid notch. An incision was made around the angle of the jaw and the parotid gland pushed forward. By burrowing with a finger he was able to get behind the pharynx and explore the region in front of the first and second cervical vertebræ. He could feel distinctly the transverse portion of the first vertebra and with some manipulation was able to discover what seemed to be a foreign body, which was slightly movable, to the inner side of the mastoid process in front of the second cervical vertebra. A porcelain tipped probe being introduced proved this to be lead. With forceps such as are used for cleft palate operations he was able to extract the ball. He then found that it had lain in a depression in front of the spinal column and that there were some small fragments of bone there. It is possible that these were pieces carried in from the perforation of the mandible. The space in which the ball lay was either the normal space between the first and second transverse processes or was a depression made by the bullet in the body of the second vertebra. The depth of the wound made it impossible to definitely determine whether the hypoglossal nerve at this point was actually divided, though it

FIG. 1.



Gunshot section of left hypoglossal nerve.

FIG. 2.



Gunshot injury of left hypoglossal nerve.

probably was cut close to the base of the skull. No attempt was made to suture it because of the danger of operating in such a region. The patient's favorable condition and the known rather unimportant results of hypoglossal injury were not such as to warrant interference.

When the man was admitted there was a good deal of difficulty in swallowing from want of control of the saliva; but at the time the operation was done he had gained fair control of these functions and the removal of the bullet seemed to be all that was indicated. The wound was treated by inserting a drainage-tube and packing.

The patient did well for a number of days. He had practically a normal temperature after a slight rise immediately subsequent to operation. On April 6th his temperature went up a little. On the 8th some moist râles in the upper part of the left lung could be heard. He complained of cough which had bothered him for about a day. The drainage-tube was withdrawn and the wound dilated, which evacuated a little fluid, and orders were given to wash the wound out with sterile salt solution twice a day. The drainage-tube was not returned, but the packing was continued. The next day his respiration was practically normal and the lung condition seemed to be better. His cough had been controlled apparently by occasional doses of five grains of ammonium carbonate and a sixteenth of a grain of codeine sulphate. The patient had been allowed for several days to sit up in bed and was advised to lie particularly on his left side to facilitate drainage.

Later sonorous râles were heard in the posterior part of the right chest. There was some tenderness on percussion of the left chest near the posterior edge of the left scapula, and a loss of resonance at the upper part of the right chest posteriorly. The gums were spongy, though no mercury had been taken to cause it. It was thought that possibly the bloody tinge of the expectoration might have come from this gingival condition. Bacteriological examination of the sputum showed the presence of pneumococcus, staphylococcus pyogenes aureus and bacillus proteus vulgaris. Urinary examination showed nothing abnormal. The temperature for a few days previous to this time and also at this time varied from 100° to 102°; the respirations from 24 to 28; the pulse from 90 to 100.

An examination of the chest made later by Dr. David Riesman showed that there was impaired resonance on the right side at the fourth and fifth interspaces over a limited area reaching to the axilla. Here crackling râles were heard with feeble breath-sounds and diminished fremitus. There was some pain in this region. The patient had had no chill and no night sweats, but was rapidly losing flesh. No tubercle bacilli were found in the sputum. His red blood cells were 2,150,000; white blood cells 26,200; hæmoglobin 85 per cent. The man was emaciated and weak, had a troublesome cough, and his throat seemed a good deal filled up with mucus. There was very little discharge from the original wound or the incision made for the extraction of the bullet. At the end of the month further operation was suggested to explore the wound and to facilitate drainage, but the man declined to submit. By the 7th of May he was very much better and walking around the ward. On the 12th of May he left the hospital without permission, considering himself well enough to go.

In July Dr. Roberts heard that the patient had been admitted to the tuberculosis wards of the Philadelphia General Hospital under the care of Dr. Ward Brinton. Dr. Brinton stated that tubercle bacilli had been found in the feces, but not in the sputum. There was, however, extensive pulmonary involvement. A few days later the patient died. The wounds in the neck and face had become healed. The Resident Physician, Dr. William Shields, had informed him the case was first thought to be one of gangrene of the lungs on account of the odor of the sputum. Tubercle bacilli were not found in the sputum nor was the streptothrix. At the autopsy six slides were taken from a cavity in the right lung and stained for tubercle bacilli but none were found.

The pathological diagnosis made was tuberculous bronchopneumonia. The pathologist was of the opinion that the gunshot wound of the neck involving the hypoglossal nerve had nothing to do with the lung condition.

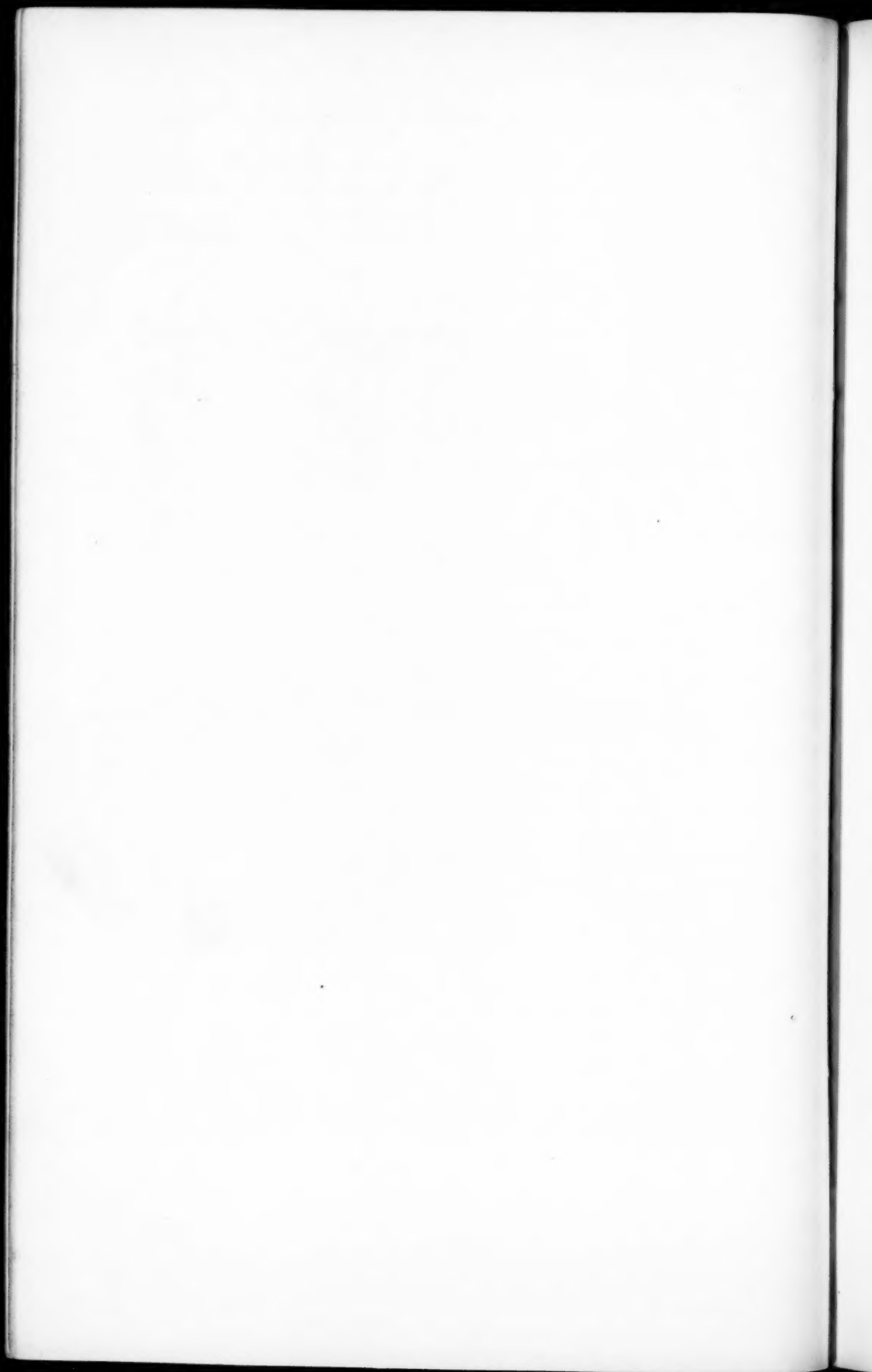
The further notes of the autopsy, furnished by Dr. Shields, are as follows:

Right pleura firmly adherent from apex to base in midaxillary line. Slight adhesions of the left pleura in the region of the first and second ribs. The pericardium contained 60 c.c. of straw-colored fluid, and extended 7 cm. to right of midsternum.

FIG. 3.



Case of gunshot wound of the left hypoglossal nerve.



In the right pleural sac there were 300 c.c. of straw-colored fluid. Heart smaller than normal, but otherwise negative. Left lung slightly emphysematous and contained some cedematous fluid. Right lung was covered with thick pleura, both layers of which were firmly attached. Both lobes were firmly attached and showed tuberculous bronchopneumonia. The lower lobe contained three good-sized cavities in which was cheesy material. The two lower cavities communicate with a bronchus. The other organs show nothing of importance. The diagnosis was tuberculous bronchopneumonia with chronic adhesive pleurisy.

Little doubt exists that in this case the hypoglossal nerve was divided. The dilated pupil and the unilateral sweating lead to the supposition that the sympathetic nerve was the seat of irritation. It is perhaps possible that the lids of the left eye suggested paresis of the facial nerve, when the real cause of their apparent loss of power was a slight protrusion of the eyeball due to sympathetic irritation. Division of the sympathetic would be expected to cause contraction of the pupil and sinking of the eyeball.

The location of the bullet in front of the second cervical vertebra near its transverse process on the left side corresponds with the upper part of the superior cervical ganglion of the sympathetic nerve. It is opposite this vertebra too that the hypoglossal nerve receives communicating branches from this sympathetic ganglion.

A missile dividing or destroying the hypoglossal nerve by pressure would be very likely to cause coincident irritation of the sympathetic ganglion in the same region. Had the patient lived, part of the spinal accessory nerve or the lingual branch of the trifacial nerve might have been transplanted into the distal part of the hypoglossal in order to restore motion to the left side of the tongue.

DR. JOHN H. JOPSON referred to a case of injury of the median nerve of a peculiar type which he had recently encountered. The man had been struck on the inner side of the arm by a piece of steel scale while driving a bolt through a piece of sheet steel. An X-ray photograph showed a very small piece of steel located in the neighborhood of the brachial artery. The patient complained at this time of tingling or electrical sensations in the ring and little finger, on the palmar surface, or in other

words, in the distribution of the ulnar nerve. Dr. Jopson saw him several days later and had a second X-ray plate made, and localized this very small foreign body in its relation to the wound of entrance, which was the only localizing point that could be utilized, being situated at about the middle of the arm. By this time the sensory disturbances had disappeared to some extent, although the patient complained of them at times when he attempted to use the arm, and still in the distribution of the ulnar nerve. There was slight tenderness over the site of the wound. On exposing the region where the foreign body had been localized a large nerve presented itself, and on examining it closely it seemed at one point to be a little swollen and injected. By probing with a pair of fine forceps Dr. Jopson found an opening in the nerve, and was able to remove the foreign body, which was deeply embedded and completely concealed in what proved to be the median nerve and not the ulnar. It was a thin scale, measuring 4 mm. in diameter. After the operation the patient had the same tingling sensations for 24 hours, but now in the distribution of the median nerve, that is, in the thumb, index and middle fingers, and not in the distribution of the ulnar nerve as formerly.

The reference of the pain to the distribution of the ulnar nerve, rather than to that of the median, was difficult to explain. The foreign body could not possibly have injured it, as the wound of entrance lay between the nerves.

DR. GEORGE M. DORRANCE said that he saw the case reported at the Polyclinic Hospital, and that he followed the patient from there to the Philadelphia Hospital, but lost track of him when his body was sent to the University. The report from the man who macerated the body was that the first cervical vertebra and part of the occipital bone was injured, and from his description of it one would imagine that the nerve was injured just as it came out from the anterior condyloid foramen. Therefore an operation would not have been of value, as it would have been impossible to reach the upper end of the nerve.